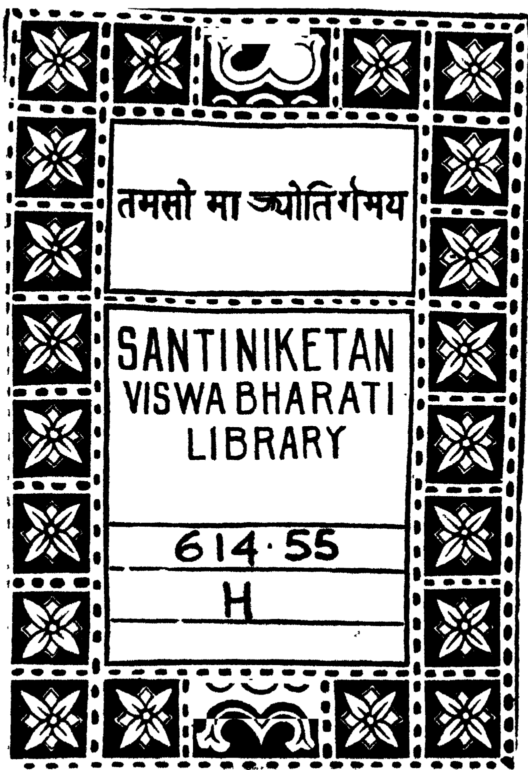

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THE CONTROL OF HOOKWORM DISEASE BY THE INTENSIVE METHOD

THE CONTROL OF HOOKWORM DISEASE BY THE INTENSIVE METHOD

BY

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AUTHOR'S NOTE

In Publication No. 1 of the International Health Board, entitled "The Eradication of Ankylostomiasis," were described the methods employed in the work directed against hookworm disease in British Guiana during 1914. The procedure there set forth has since come to be known as the "Intensive Method." It is being used in many countries in which measures against hookworm disease have been undertaken, and has been found to be applicable under a great variety of conditions.

The continued demand for Publication No. 1 has led to the preparation of this new edition, which aims to bring the description of this working plan up to date by showing the modifications and developments which it has undergone since the original pamphlet was issued. Unlike Publication No. 1, which dealt entirely with the work in the Peter's Hall district of British Guiana, the present publication is intended to cover not the specific details of a campaign in any one country, but the general procedure followed in conducting any demonstration against hookworm disease by the intensive method.

H. H. H.

NEW YORK CITY,
December 31, 1918

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APPENDICES

I

PROBLEM OF HOOKWORM CONTROL

1. **Magnitude of the Problem.** Hookworm disease is found in practically all countries which lie in the tropical and sub-tropical zones, extending from parallel 36 degrees north to parallel 30 degrees south. More than half the population of the globe lives in this area. The control of this disease is therefore an undertaking of enormous magnitude, which can be accomplished only by permanent agencies working over a long period of time.

2. **Theoretical Simplicity of Control Measures.** There is probably no other disease, certainly no other parasitic disease, of which our knowledge is so complete as of hookworm disease, and for which we have two or more specific drugs. There is not a stage in the life-cycle of the hookworm with which we are not thoroughly familiar, from the moment the egg reaches the soil in the feces of its former host and hatches into the larva, throughout all the stages of development, until, in its encysted stage, it enters the human body and finally reaches the small intestine, there to live for eight or ten years and to reproduce its kind

by countless thousands. Every detail of its life-story and of the environment necessary for its development has been made completely known to us by the researches of scientists.

With such thorough knowledge it has been an easy task to elaborate a perfect theory for the prevention of the disease. Only one thing is necessary: that is, to prevent soil pollution, or, in other words, to keep the hookworm ova from reaching the soil, where they can hatch and develop into infective larvae. If those who have hookworm disease can be located and cured, and if we can prevent others from contracting the disease, then, theoretically, complete eradication is an accomplished fact.

3. **Practical Difficulties Experienced in Carrying out Control Measures.** Although the problem of complete eradication seems simple on paper, it is not so in fact. Many difficulties arise to prevent working it out to the end. Virtually every difficulty, however, may be rightly attributed to one cause: lack of proper co-operation on the part of the people who are to be most benefited. This is strangely true of every undertaking, however benevolent in nature, where voluntary co-operation on the part of the masses is a factor for success. To accomplish the complete eradication of hookworm disease in any area we need

only to make a microscopic examination of every one living therein, to treat every one found infected until he is cured, and to bring about the installation and use of sanitary conveniences that will put an end to further pollution of the soil. But there are obstacles in the way of each of these apparently easy steps.

a. The examination of every individual in a given area will rarely, if ever, be possible. There will always be those, few or many as the case may be, who will refuse to submit specimens. A false sense of modesty will deter some; others, because of social prominence, wealth, or intellectual attainment, will take it for granted that they are immune to the disease. Mildly infected persons, feeling in good health and believing they have no need of treatment, will not be convinced that, as carriers, they are dangerous to their communities. A few will be openly hostile, fancying that they see in the campaign an attempt to interfere with their personal liberties; while the full co-operation of others will sometimes be withheld through ignorance, superstition, indifference, or neglect.

b. Cure depends upon the willingness of the patients to take treatments for a sufficient length of time. As in the case of examination,

and for the same reason, there are some who are unwilling to be treated, even though they have been examined and found infected with the parasites. There are others who lose patience and abandon treatment short of cure, and a small number who must be refused treatment because they are suffering from other diseases or conditions which prohibit the use of an anthelmintic. Usually the number refusing or abandoning treatment is smaller than that refusing examination in the first instance.

c. The failure of the people to give perfect co-operation in these first two phases of a campaign must result in the main from misinformation and misunderstanding; it is chiefly here that the patience, persistence, and tact of the medical director and of the nurses come into play.

d. The installation and use of proper sanitary conveniences to prevent further soil pollution it is possible to bring about. This has been proved in some of the West Indian colonies. Compulsory laws with penalties, if enforced, will secure results; but better and much more to be desired are the results obtained by the education and enlightenment of the public to the point where eventually it will demand such improvements. After sanitary conveniences are installed, we still face the

difficulty of holding the people to the use of them. This has not, however, proved in our experience the hopeless task that some have thought it to be. In the West Indies, with their mixed population, the patient, tactful, and yet firm handling of this question has brought really remarkable results.

e. If it were possible to accomplish perfectly the above purposes of the campaign, there would still remain for a time the danger of re-infection from hookworm larvae already in the soil, which we know live, under favorable conditions, for some months. Because of the labor involved, it is often impracticable to attempt to locate areas where the soil is infected with hookworm ova and larvae; and if such areas were located they would probably be too extensive to justify attempts to render them innocuous or to keep people away from them.

Attempts at the destruction of hookworm ova and larvae in the soil by the use of chemicals have not been very successful. In a paper read before the Society of Tropical Medicine and Hygiene by Sir Thomas Oliver in 1910, the statement is made that: "The one salt which has given the most satisfactory results all around is iron sulphate. It is estimated that one ton of this in a one-per cent solution

would cover a length of sixty miles more than a yard wide and one-third of an inch deep." This solution was used to a limited extent in the first organized effort against the disease in British Guiana, but it was most difficult really to prove its efficiency. A more practical step was to burn brush and trash piles on spots likely to be infected, such as sites of surface closets, stooling places in thickets and in the cane-fields, and vegetable patches.

It would be possible, of course, to meet these particular difficulties by keeping the entire population under observation until sufficient time had elapsed for all hookworm larvae in the soil to die — probably about ten months; or by returning to the area to find and cure the cases resulting from such re-infection.

4. **Responsibility of Local Agencies.** The International Health Board does not undertake on its own account to relieve and control hookworm disease in any country. If the work is to be successful, the state or country in which the infection exists must assume the burden and responsibility. The Board has had the privilege of sharing in the work in various countries, however, by making contributions toward its support and by lending a few well-trained men to aid in its organization. This co-operative effort is intended in most instances

to serve as a demonstration, which, by proving the feasibility of attaining the end in view at a non-prohibitive cost, will lead to the establishment of permanent agencies to extend the work to wider fields.

In its co-operative efforts with the different states and countries, the Board leaves the preventive side of the problem — that of securing the installation or improvement of latrines followed by the continued maintenance and use of them as a safeguard against infection and re-infection — entirely in the hands of the local governments. Though its field forces devote a certain proportion of their time to educating the people in sanitation, this is but an incident of the Board's work, its immediate object being the examination of the people and the treatment and cure of those infected.

II

INTENSIVE METHOD OF ATTACKING THE DISEASE

5. **Definition of the Intensive Method.** The intensive method may be briefly defined as an attempt "to approximate, as nearly as practicable, the complete relief and control of hookworm disease within a given area." [1] The plan of operation comprises two undertakings, each with its own agency. The first of these undertakings, for the maintenance of which the International Health Board contributes funds, endeavors to treat until cured all infected persons dwelling within the area; the second, financed by the government and operated by its sanitary organization, aims to make effective such measures as will prevent re-infection. The scheme for treating the infected requires: mapping the territory, locating roads, streams, villages, houses; taking a census of the population, numbering the houses in which the people live, recording name, age, sex, race, and post-office address; making microscopic examination of the entire population; putting under treatment all persons found infected; and continuing treatment of each patient until microscopic examination following a standard-

[1] First Annual Report, International Health Board, p. 28.

ized procedure shows that a cure has been effected.

While this work is being carried on, a systematic effort is made by means of public lectures, the distribution of literature, newspaper articles, and house-to-house visits, to educate the people, not alone with regard to the cure and prevention of hookworm disease, but also as to the dangers of soil pollution and its close relationship, as a causative factor, to many other diseases.

This method of conducting intensive operations in well defined areas has advantages that are worthy of special note: namely, the work is definite and thorough and closely approximates completeness; and where the sanitary work keeps pace with the work of treatment and cure, the results are lasting. By this means the government is enabled to begin a definite sanitary work on the basis of an almost insignificant expenditure, and to train and enlarge its sanitary force gradually as the work is extended from area to area, and as the people are educated to the point of giving greater co-operation.

6. **Development of the Intensive Method.** It was in British Guiana on March 12, 1914, that work by the intensive method was undertaken by a foreign country in co-operation

with the International Health Board for the first time. Following the visit to this colony in October, 1913, of the Board's General Director, a working plan and budget, prepared by the Surgeon General with the assistance of Dr. J. E. A. Ferguson, Medical Officer of Peter's Hall district, were submitted to the Board. This plan and budget were adopted, and it was decided to select a medical district as the area of operation in the preliminary campaign.

The Peter's Hall district, just south of the city of Georgetown, was chosen. This district is approximately eight miles long and from one to three miles wide, with a population of 14,000 people, exclusive of the indentured labor on the sugar plantations. It contains few isolated dwellings. The people live in a chain of villages, varying in size from 200 to 4,000 inhabitants, lying along the east bank of the Demerara river. The indentured plantation laborers were not to be dealt with, as they were already being handled effectively by Dr. Ferguson at the expense of the plantation owners.

The writer, who, as a member of the medical staff of the International Health Board, had been selected to co-operate with the Colonial government in carrying on the work, arrived in Georgetown on March 9, 1914. It became

at once evident that there were features of the problem in British Guiana which neither the work conducted against hookworm disease in the United States by the Rockefeller Sanitary Commission, nor the local efforts in the colony to control it among the indentured laborers on the plantations, had encountered. In the United States the sanitary conditions are not made worse by heavy tropical rains. Moreover, the temperature in the winter months not only compels the people to wear shoes, thus protecting themselves from infection as well as from cold, but also kills off hookworm larvae in the soil. In British Guiana the temperature is always warm. The people go barefoot the year round, and at certain seasons there are heavy rains almost daily.

In the United States the population that had been handled was made up of blacks and whites only, and was intelligent enough to be amenable to reason. In British Guiana the indentured labor that had been and was being handled was made up almost entirely of East Indians subject to estate discipline. But in the Peter's Hall district, on the other hand, the population was very heterogeneous and difficult to influence. There were East Indians who had served out their indenture, and who, being no longer subject to discipline, were, like the

rest of the population, intolerant of it. There were numbers of Portuguese, especially susceptible to the disease, severely infected, and yet stubbornly indifferent to all efforts made to cure them. There were Chinese, who are averse to taking medicine of any kind unless they are suffering acute pain; and blacks, the more ignorant of whom gave trouble all along. Only the "coloreds" could generally be depended upon for co-operation.

The task of unifying all these diverse elements of population and of creating among them an active common interest in measures for the control of a disease about which they were entirely ignorant and utterly indifferent, was no small undertaking.

We have since found these general conditions repeated in all the other West Indian colonies where we have taken up work against hookworm disease. There are a few minor differences. In Dutch Guiana ten per cent of the population is Javanese, mainly indentured laborers; in most of the northern islands the East Indian element is lacking; and in certain of the colonies the free population is found more in isolated rural homes than in strings of villages. Elsewhere than in British Guiana we have undertaken the indentured labor as well as the free population.

In the experimental campaign in Peter's Hall district the original plan of operation underwent rapid and radical changes in the course of our contact with actual conditions: the area of operation was considerably reduced, and efforts within the smaller area were intensified. Satisfactory progress soon gave evidence of the wisdom of these changes, and subsequent experience with the method thus evolved has fully justified expectations and has led to its being adopted as the exclusive type of work for the West Indies. To inaugurate and conduct a campaign by this method it is desirable that a definite line of procedure should be followed, which will be described step by step in subsequent pages.

III

SELECTION OF AREA OF OPERATION

7. **Size of Area.** The temperament of the majority of the people in the West Indian colonies is such that their interest soon wanes, even in an effort which looks to their improvement and benefit. In this respect they probably do not widely differ from people living in other areas in the tropics. Furthermore, a large proportion are without permanent places of abode and move about from locality to locality. These two conditions suggest the desirability of concentrating the efforts of a unit of working force on a comparatively small population, of waging a rapid and aggressive campaign, and of bringing the campaign to a close before the people lose interest or before removals and additions to the population seriously invalidate the original census.

The size of the area will largely be determined by the size of the unit of working force, but if the unit of working force described on page 37 is accepted,[1] experience indicates that it is best to select an area with a population sufficient to give each nurse from one

[1] One medical director in charge, two clerks, four microscopists, twelve nurses, and one or two low-salaried helpers or caretakers.

hundred fifty to two hundred cases to treat. Thus, with twelve nurses in the working force, the area selected would include about 2,400 infected persons. In the West Indies, where the average rate of infection has been found to be 65 per cent, this has meant that the average area has had a population of about 3,600. Usually the campaigns are preceded by survey work, which enables an estimate to be made of the degree of infection prevailing throughout the territory to be covered.

The size of the area which will supply the desired population will, of course, vary in accordance with the density of population. In sparsely settled sections, owing to the distances to be covered by the nurses in visiting their patients, the selection of a smaller population than that named may be advantageous, while in densely populated sections or in villages a larger population may be handled.

8. **Rate of Handling the Population.** The progress made by a unit of force in handling a given population is indicated by figures compiled in the work in Trinidad and in British Guiana. In Trinidad, in a campaign which covered the six quarters from July 1, 1915, to December 31, 1916, and in which a working unit of about the standard size was engaged, the following averages per quarter were obtained:

Table I — Average Number of Persons Enumerated in Census, Examined, Found Infected, Given First Treatment, and Cured per Quarter in Trinidad, British West Indies — July 1, 1915, to December 31, 1916

Census	2,754
Examined	2,615
Found Infected	1,961
Given First Treatment	1,712
Cured	1,283

In British Guiana during the quarter ending December 31, 1916, the following statistics were compiled:

Table II — Number of Persons Enumerated in Census, Examined, Found Infected, Given First Treatment, and Cured in British Guiana during Quarter ending December 31, 1916

Census	7,796
Examined	7,471
Found Infected	4,174
Given First Treatment	3,641
Cured	2,233

There were 1,293 patients remaining under treatment at the close of this quarter, so that the campaign was likely to continue for six weeks or two months longer until they were cured. Five microscopists and twenty-one nurses were included in the working staff, but the difficulties experienced by the medical director in keeping in intimate touch with the

details of the work of so large a force led to a reduction in the number of nurses and microscopists to normal proportions.

9. **Duration of Work in Area.** An examination of the figures given above indicates that approximately three months are required for a unit of force such as is recommended, operating under average conditions, to complete work in an area which includes from 1,800 to 2,400 infected persons.

10. **Division of Area into Nurses' Districts.** After an area of operation has been selected, it is divided into nurses' districts, each containing approximately the same number of infected persons, with such variations as the density of population and the consequent distances to be traveled by the nurses may indicate. A nurse is held responsible for every detail of the work in his district.

11. **Consolidation of Nurses' Districts.** Near the conclusion of the period of treatment, when the total number of cases remaining uncured in several nurses' districts combined has been reduced to one hundred fifty or two hundred, these several districts are put in charge of one nurse, who continues to administer treatment until all of these cases have been cured. The nurses thus released from their old districts are transferred to others within a new area of

operation. This new area usually adjoins the old. By following such a plan of consolidation, the entire force, both in the field and in the office, keeps working at full capacity and the per capita cost of the work is materially reduced.

IV

PUBLICITY AND EDUCATIONAL MEASURES

12. **Education the Primary Aim of an Intensive Campaign.** Although the intensive method has been defined as an attempt to approximate the complete relief and control of hookworm disease within a given area, the whole work is essentially educational: it is teaching the people by practical demonstration. Among the natives in many tropical countries, the story must be presented in direct and concrete terms. Here the medical directors rely upon word of mouth; and as they tell the story they illustrate its details by lantern slides, photographs, and objects. They use typical cases as object lessons; they point out the gross clinical symptoms, which the people soon learn to recognize; they get specimens of the patients' stools and exhibit the eggs of the parasite under the microscope; they show the parasites that have been expelled by the treatment administered; and by means of the microscope they exhibit the living, squirming embryos that live by teeming thousands in the soil that has been befouled by an infected person and that are ready to infect any person

with whose bare skin they come into contact. The recovery that follows treatment and cure tells its own story, both to the patient and to his friends and neighbors. The disease thus lends itself so readily to simple demonstration that the people — even native populations of tropical countries — easily understand its whole story. They learn to recognize hookworm disease by its clinical picture; they have seen the parasite that causes it and the eggs by which infection is demonstrated; and they see how the infection is spread and how it may be prevented. As a result of this educational work, the people co-operate helpfully, in both the work of treatment and that of prevention.[1]

13. **Purpose of Educational Work.** The publicity and educational work begins immediately after the area of operation has been selected, and is continuous throughout the campaign. The people within the selected area must be informed about the disease and be interested in it to such a degree that they will voluntarily submit themselves for examination, and be willing to take treatment if found infected. In addition, they should be taught the facts concerning the transmission of hookworm disease from individual to individual

[1] See First Annual Report, International Health Board, pages 38–39.

through soil pollution, and the necessity of each household providing itself with a latrine of proper type, so that the use of this latrine by every member of the household may stop the further spread of the disease. In educating the people on these points, a favorable opportunity is afforded for valuable lessons on the prevention of disease in general. This opportunity is not overlooked: every possible influence is brought to bear; and while the means used vary somewhat with locality and country, certain lines of effort, mentioned below, are common to all.

14. Lectures. On the opening of activities in a new area, it has been the practice to arrange for the delivery, at some convenient gathering place, of an evening lecture illustrated with stereopticon slides. To this lecture the government officials are especially invited, and particular effort is made to have present as many of them as possible. Village officials, clergymen, schoolmasters, heads of societies, health officers, members of mission boards and of clubs, local representatives of the press, and officials of planters' or agricultural organizations, are also urged to attend. In addition an invitation to the general public is widely circulated.

The lecture is delivered by the medical director — if need be with the aid of an inter-

preter — and includes not only a discussion of hookworm disease, but an explanation of the origin of the activities to be undertaken against it, the purpose of these activities, the sources of the funds to be expended in the work, the necessity for the co-operation of the people, the benefits to be derived from such co-operation, — individually and collectively, — and the importance of sanitation under government supervision. Expressions from prominent men in the audience are cordially invited. If possible, arrangements are made for a representative of the government to preside at this meeting. Every effort at this and at all subsequent stages is made to identify the work with the central and local government agencies.

As the work in the area proceeds, other less formal lectures are delivered to schools and societies, or wherever a sufficient number of people can be gathered together.

15. **Distribution of Literature.** The distribution of literature dealing with hookworm disease, its detection, treatment, cure, and prevention, prepared in language simple enough to be intelligible to the people, is of undoubted value and should not be neglected. Often, because several different languages are spoken in the area, these pamphlets and posters have to be printed in a number of tongues. Literature

especially prepared for use by local teachers in instructing native children concerning hookworm disease and other prevailing diseases, as well as concerning the dangers of soil pollution, is of paramount importance. Experience has shown that the average schoolmaster is more than willing to use this literature and thus to lend his aid and influence to the work.

16. **The Press.** The local press gives valuable voluntary support by publishing at intervals, with favorable comments, reports giving various details of the progress of the work.

17. **Microscopic Demonstrations.** Microscopic demonstrations of the presence of ova and larvae in feces are useful as a means of convincing the doubtful and of securing their co-operation. These demonstrations are held at the laboratory or in the homes of the people. The confidence and support not only of the professional class but of intelligent classes generally, are gained by welcoming them to the laboratory and by inviting their attention to every detail of the work, both there and in the field.

18. **Nurses as a Means of Publicity.** The nurses, in their frequent calls at the homes within the area to collect specimens and to administer treatment, have many opportuni-

ties to win the confidence of the people and to conduct valuable educational work. It has been the practice of some medical directors to give the nurses a special course of instruction to fit them fully for this phase of their duties.

V
WORKING FORCE

19. **Size of Working Staff.** Experience gained in the campaigns conducted in the West Indian colonies during the past four years has shown that a working staff of the following size is, all in all, the most efficient unit for the relief and control of hookworm disease by the intensive method: one medical director in charge, two clerks, four microscopists, twelve nurses, and one or two low-salaried helpers or caretakers.

There is a definite ratio between the different elements of this unit of force. Only three of the microscopists work with microscopes; the fourth is chief microscopist, verifying and recording the work of the others and instructing them in their duties. Under average conditions it requires four nurses actively engaged in their routine work in the field to supply sufficient specimens to occupy the time of one microscopist. A force of the size suggested will reach so many people, and cover so extensive an area, that the full time of one medical director will be needed to supervise it. For this reason it is considered as large a force as can be effectively managed by one director. If it

is desirable to handle the population of a country more rapidly than is possible with a force of this size, it is better to increase the number of units than to alter materially the proportions between the different groups of employes composing each unit.

The maximum number of employes in one unit of working force was reached in one of the West Indian colonies during the first half of 1916. Here the force consisted of one medical director, four clerks, five microscopists, twelve nurses, thirty-one assistant nurses, and three caretakers, — a total of fifty-six persons. This force was maintained at a monthly cost of $1,346.21. Not all of these fifty-six persons were engaged in the work conducted from the central office, small dispensaries having been established at various points, where microscopists, nurses, and their assistants carried on their duties with occasional visits from the director.

The results of this experiment, and of other experiments similar but of smaller scope, show very clearly that it is not advisable to enlarge the force and to increase the area of operation to undue dimensions if the campaign is to retain those characteristics which justify the term "intensive." Rather, the object should be to organize a well-balanced force and to concen-

trate its efforts on a comparatively small area and small population, in order to accomplish the end quickly and pass to a new area. Such a course permits the medical director to supervise every detail of the work, and to have intimate daily knowledge of every important occurrence. This detailed supervision by the director is very essential, since in the West Indies he must operate in every instance with a force locally recruited, whose members have had no other special training for the work than that which he is able to give them; and this training can be made effective only in so far as the medical director can supervise their work.

20. **Branch Offices in Area.** The establishment of branch offices at various points throughout the area, for doing microscopic work or as a rendezvous for nurses engaged in giving treatment, has not led to efficiency in any instance. It seems rather to invite the forces stationed at these remote points, free from the surveillance of the medical director, to follow their own devices. Certainly, if the results of microscopic work are to have more than doubtful value, that work should be done at the central laboratory under the personal supervision of the director.

21. **Duties of the Medical Director.** The medical director is the administrative and

medical head of the field unit. He directs the work while it is in progress, and is responsible for the results accomplished. He must have control of his force, and must be in position to apply discipline or reward merit without delay and without the intervention of a third party. To command his force and secure efficient work, he must have the power to terminate, with legal notice, the services of any undesirable member. Every subordinate in the West Indies is therefore asked to sign an agreement in which he places himself under the authority of the medical director, and offers to discharge, to the best of his ability, whatever duties may be assigned to him. A copy of this agreement appears in the appendix, page 172.[1]

22. **Relation of Medical Director to Government.** Inasmuch as the intensive campaign is intended as a demonstration of the possibilities of a direct and definite attack upon a prevailing disease, both the organization of the force and the direction of its activities must be considered as only a temporary first step toward the establishment of permanent agencies which shall in time apply similar or better

[1] In this connection it may be stated that the practice of using government employes as subordinates in the force, by having them "seconded" from government departments to this special service, is open to objection, both theoretically and from experience.

methods to the control of all diseases. The most successful work, then, is that which brings to the public such keen realization of benefit that it is prepared not only to co-operate in further and more comprehensive undertakings of similar nature, but to insist that permanent agencies be established to continue such work. With this end in view, the medical director should be stimulated to secure the highest degree of efficiency from his force, so that with and through its members he may render the greatest possible service and leave behind him when his work is finished, as a legacy to the government which has welcomed his coming, a public converted to modern ideas of sanitation and the prevention of disease.

23. **Relationship of Medical Director to the People.** The proper relationship between the medical director and the people is one which can be neither established nor maintained by proxy. Early in the work the medical director visits all parts of the area and becomes personally acquainted with the people. At all times he is accessible to them, and shows sympathetic interest in their attitude and viewpoint regarding the work. Before treatment is given, he calls at the homes of all persons found infected, to ascertain whether or not treatment can safely be administered to them,

and also to prescribe the proper dosage. This personal service and attention is a very important factor in securing the co-operation of the patients in taking treatment until cured.

24. **Duties of Clerical Force.** The clerical force is needed to record statistics and to formulate reports. This work is done under the immediate supervision of the medical director. At least one of the clerks should be a typist. Inasmuch as the nurses work on Sundays and have Wednesdays off, they leave their treatment books in the office on Wednesdays, when the clerks transfer from the nurses' books to the case-record book retained in the office, all data which have not previously been entered in the case-record book.[1]

25. **Duties of Chief Clerk.** The chief clerk is in charge of the stock of drugs and specimen containers, and issues supplies of these items to the nurses as required. Each nurse is charged with the supplies issued to him, and is provided with a locker in which to store them. On Wednesdays, when the nurses are off duty, the amount of supplies used by each nurse, as shown in his reports, is deducted from the list of supplies issued to him, and the con-

[1] For a discussion of the methods used in recording and reporting information, as well as for samples of the various forms used, see pages 123 to 164.

tents of his locker are checked with the remainder. In this way it is possible to account for all supplies issued. After checking the reports of the nurses, the chief clerk makes out and posts in the office a sheet showing: (*a*) the number of treatments given by each nurse during the past week; and (*b*) the total number of treatments to date given by each nurse in his district. The names of the nurses appear on this sheet in the order of their merit and efficiency as shown by the number of treatments they have given. This stimulates interest and a wholesome spirit of rivalry, and leads to more efficient service.

26. **Duties of Chief Microscopist.** The chief microscopist is held responsible for all the work of the microscopic department. In addition to instructing new men, he verifies and records all findings of his assistants, and checks up their daily reports. He receives the specimens brought in by each nurse, gives the nurse a receipt for them, and reports to the medical director the failure of any nurse to get specimens at the proper time for first examination or for re-examination. It is his special duty to see that the nurses are informed promptly of the results of re-examination, so that there may be no delay in the course of treatment. He is held responsible for the scientific equip-

ment of the laboratory, and for maintaining the methods and technique prescribed by the medical director.

27. **Duties of Microscopists.** The microscopists examine, according to the technique and laboratory procedure prescribed by the medical director, all specimens submitted to them by the chief microscopist. They aid the chief microscopist in keeping a record of all specimens coming into the laboratory for examination and in preparing the daily and weekly reports of the work of the department, and they perform any other duties which may be assigned them by the medical director or the chief microscopist. In the early part of a campaign they often help in taking the census, and when not otherwise engaged assist in the clerical work. On Wednesday of each week, in the absence of the nurses from duty, the microscopists finish any laboratory work which may be waiting, prepare a week's supply of magnesium sulphate solution, and clean their laboratory equipment.

28. **Selection of Microscopists.** In choosing microscopists, preference is given to men between twenty and twenty-five years of age. Probably the best class available in the West Indies consists of natives of East Indian parentage, who, having profited by the educational

advantages of the local schools and institutions, are above the average in intelligence. They are quick to learn, and accurate and rapid in their work. Members of the black or colored races are also employed.

29. **Training of Microscopists.** It is seldom possible to secure men for microscopists who have had previous laboratory experience. The medical director therefore has to train his force of microscopists when the work is begun in each country. Since the technique and laboratory procedure are not elaborate and lend themselves particularly well to the training process, the men soon acquire the necessary skill to distinguish the ova of various intestinal parasites. As early as practicable, the most intelligent and most skilful of the microscopists is made chief microscopist, and later, when he has fully proved his skill and fitness, the training of new men engaged to examine specimens devolves upon him.

30. **Duties of Nurses.** As stated on page 26, the area of operation is divided into districts, each of which is placed in charge of a nurse. This nurse takes a census of the people in his district, recording in his census book such facts as are required. While taking the census he delivers to each person a tin container properly marked with his name, age, and house

number, at the same time giving directions as to how the specimen of feces to be placed in the container shall be prepared, and stating that on the following day he will call for the specimen. On his first visit to each house the nurse inspects the sanitary accommodations and enters in the census book the conditions found. On later visits he collects specimens and delivers them to the laboratory for examination. As the specimens from people in his district are examined, he is informed of the results, and records in his treatment book the names of all persons found infected. He then calls upon each of these persons and arranges the day of the week upon which that person will take treatment, as well as the day upon which the medical director may call and examine him. Treatment is then administered according to the instructions issued by the medical director.[1]

In work by the intensive method it is required that each patient be treated once weekly, on the same day of the week, until cured. To make this possible the patient is re-examined on the seventh day after treatment. It is the duty of the nurse to secure specimens for re-examination seven days after

[1] For a detailed discussion of the method of treatment, see pages 69 to 94.

the second treatment, and seven days after each successive treatment until the patient has been cured. So few persons are cured by one treatment that no re-examination is made after the first treatment.

The nurses are expected to administer personally every dose of medicine necessary in the treatment, and to keep in close touch with the patients on the day of treatment. They are responsible for all supplies issued to them. Once weekly they must account for these supplies, and the value of any shortage not explained satisfactorily is deducted from their wage. They are required to make a daily and weekly report of their activities. Sunday being a day of idleness, many people elect to take treatment then. This requires that the nurses work on Sunday, in consequence of which Wednesday of each week is given them as a rest day.

31. **Duties of Chief Nurse.** Usually the most skilful of the nurses is placed in charge of his fellow-workers. His principal duties are: (1) to visit the various nurses' districts, making inquiry of the people to ascertain if the census has been properly taken, if specimens are being obtained from every individual at the proper time, and if treatments are being given regularly and correctly; (2) to visit and

attempt to secure the co-operation of malcontents among the people; (3) to see whether specimens are being collected for re-examination at proper intervals after treatment; (4) to keep account of the medicine issued to each nurse, and, by checking off the total used at the end of the week, to ascertain if the quantity remaining is correct; and (5) to call to the attention of the medical director any irregularity, or any matter requiring his personal attention. These duties are very important and for this reason the chief nurse should be a very trustworthy person.

32. Selection of Nurses. The nurses, like the microscopists, are recruited locally. They may represent any one or several of the different elements of population. They are men usually older than those employed as microscopists, and are often of the schoolmaster class. Generally they have had no previous experience in caring for the sick. They should write legibly and should possess sufficient clerical ability to enable them to take the census and to keep their treatment record books. Above all, they should be trustworthy, for they must discharge their duties, most important in nature, in the field, where they cannot be always under the eye of the director.

The employment of young, immature nurses

because they may be had at small salaries is a very doubtful economy. To entrust to any but the best type of men available the important duties performed by the nurses is to endanger the success of the work. The nurses should be mature men, with a history of honesty and faithfulness to duty in previous services, and should be permanent members of the force so long as they perform the duties expected of them. The experiment has been tried of employing schoolmasters and others for a portion of each week, for a few hours of each day, or for a few days during the height of a campaign. In several instances the results have been far from satisfactory. They are not under the discipline and control of the medical director, and have little to lose if their services are found unsatisfactory. Consequently they show only a selfish interest in the work.

33. **Training of Nurses.** The training of the nurses in the administration of salts and thymol or chenopodium is not a difficult matter, as unusual skill is not required to employ these comparatively safe drugs, and as a safeguard against unpleasant accidents, the medical director is always near at hand to be summoned in those rare cases where disturbing symptoms develop. In the thousands of cases treated in the West Indian colonies we have never had

serious symptoms produced by thymol, — the drug of our choice. The practice of our directors of making a personal clinical examination of every infected person, to test the heart and lungs by stethoscope and by percussion, and also to prescribe the proper dose of thymol for each, probably accounts in large measure for this freedom from serious symptoms.

When new men are taken into the nursing force, the medical director delivers a series of short lectures to give them a practical working knowledge of their duties, especially those concerned with the art of approaching the people and of gaining their confidence and co-operation. In addition, these lectures deal with the method of administering thymol, with its contraindications, its toxic effects, and with the simple antidotes which ordinarily will relieve these effects. A clear and non-technical account of the life history of the hookworm, emphasizing the close relationship of soil pollution to the spread of the infection, is also given. Before a recruit to the nursing force is given a position as nurse, with responsibilities of his own, he is required to spend at least a fortnight in observing the work of other nurses in the field.[1]

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[1] Special instructions issued to nurses by the medical director appear in the appendix, section V.

34. **Duties of Caretakers.** The caretakers are generally boys or women who are employed to sweep, wash slides, bury refuse, and run errands. They may be hired at very moderate salaries.

35. **Salaries of Subordinate Employes.** In the West Indies a maximum salary of $50.00 a month has been fixed for the chief clerk, and a correspondingly lower sum for his assistants. The maximum for the nurses and microscopists has been fixed at $40.00 a month, but they receive this only after a considerable term of faithful and efficient service. Only a small part of the microscopic and nursing force in the West Indies has yet reached the maximum wage. Though these salaries may seem small, it should be remembered that conditions in the West Indies are quite different from those in most other countries, and that living expenses are comparatively very low. The salaries paid our employes are above those which usually they could earn in any other line of work, and we have had no difficulty in hiring men of the right type on these terms.

36. **Allowances for Subordinate Employes.** No subordinate employe is paid any allowance for travel, for sustenance or quarters, or for any other purposes. In all instances allowances for such items are reckoned and included

as part of the salary. For a certain monthly payment each employe must render satisfactory service, and must provide himself at his own expense with a bicycle or such other means of travel as may be judged necessary by the director. This arrangement relieves the director and the clerical department of the necessity of keeping numerous petty accounts, and greatly simplifies the question of remuneration for the force.

VI

CENSUS TAKING

37. **Necessity for Accurate Census.** To make effective any plan for the complete relief and control of hookworm disease, it is necessary to secure a correct census which will embrace all individuals within the field of operation; to record the personal history of each individual as to name, race, sex, and age; and to number or mark each house, making this number a part of the record, so that every individual may be located at any time. This census is taken by the nurses. It is a decided economy in time if the nurses, when they are taking the census, also deliver to each individual a specimen container marked with his name, age, and house number, and request him to prepare a specimen of his feces which will be called for on the following day. A survey of latrine conditions at each home is made at the same time the census is taken, and is included as a part of the census report. By this means the sanitary problem of the area is at once determined.

38. **Method of Taking Census.** In carrying out the work of census taking, the procedure has been to have the nurses devote the forenoon

to collecting specimens from individuals visited on the previous day, and the afternoon to taking the census and giving out containers at other homes. As early as practicable in the work, the nurse is required to prepare a map of his district showing by number the location of each house. When these local maps are all in, a large map of the entire area of active operations, to be retained for reference in the office, is prepared from them.

Small books are prepared for the use of the nurses in taking the census. These are of such size and number that at the end of each day's work the book used on that day may be left at the central office for the purpose of transcribing the data in the permanent record book (see sample page of census book, pages 124 and 125).

VII

MICROSCOPIC LABORATORY

39. **Importance of Laboratory Work.** In a campaign against hookworm disease the microscopic laboratory furnishes information which is the basis for every other phase of the curative work. It is here that we discover in the beginning those who are infected, and hence, those who are to be treated; and that later, at the conclusion of the treatments, we determine who have been cured. Work so important and upon which so much depends deserves the utmost care and attention to detail.

40. **Variations in Microscopic Technique.** In our work the diagnosis of hookworm infection is based upon the presence of hookworm ova in the feces of the host. This presence can be determined most readily by microscopic examination. The methods used in preparing the feces for examination and the technique of examination followed are therefore important considerations. Many techniques have been devised for the examination of feces for parasitic ova. All are directed to the same end, but not all are equally accurate nor sufficiently practicable for our purposes, which involve the examination of thousands of specimens under conditions often far from ideal.

Concentration is a common characteristic of nearly all these methods, and is attained, respectively, by comminution of the feces, by the use of sieves, by sedimentation, centrifuging, or by washing in water. Before any method of concentration can be employed, the fecal mass must be broken up, to set free the embedded and adherent ova, and water or some other agent must be added to obtain fluidity.

In the work in the West Indies in which the International Health Board has participated, unusual difficulties have had to be met in organizing a laboratory force and in selecting a technique which would promise accuracy in results. It was necessary to have: first, a method that was rapid without sacrifice of accuracy, so that large numbers of specimens could be handled at a minimum cost; second, a technique that was simple, requiring the minimum of skill on the part of laboratory employes, none of whom, as a rule, had had previous experience or training in such work, and so had to be taught all that it was necessary for them to know; and third, a procedure whereby every fecal specimen submitted would be so handled that the microscopic findings would be the result of the inspection of two or more microscopists, one of them an expert. The last feature was intended to eliminate

the element of error which always exists to greater or less degree in individual effort or research, and to place an effectual check on the more insidious harm often resulting from the employment of careless or dishonest persons.

41. **Original Technique in British Guiana.** In our first work in British Guiana in 1914, our technique of examinations was that given by Dock and Bass.[1] It consisted of the examination of at least three direct smears from each specimen on 1 x 3 inch microscope slides before negative findings were recorded. We realized that this method permitted many light infections to escape observation and we adopted it only temporarily, as a starting point from which to develop a better technique.

Later the accuracy of this direct smear method as compared with that attained by our present method of examination was put to test by certain experiments undertaken in British Guiana[2] and Trinidad.[3] In the two colonies a total of 2,134 specimens was examined first by one method and then by the other; 700 specimens in British Guiana and 1,434

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[1] "Hookworm Disease," Dock and Bass, pp. 159–161.

[2] Report of Dr. F. E. Field, Supervising Medical Officer of Ankylostomiasis Campaign in British Guiana, 1914–1916, I.H.B.

[3] Report of Dr. B. E. Washburn, Medical Officer in Charge of Ankylostomiasis Campaign in Trinidad, 1915–1916, I.H.B.

in Trinidad. In the test made in British Guiana, five direct smears on 1 x 2 inch slides were required before a negative finding was accepted; in Trinidad, three smears on 2 x 3 inch slides were required. The result of the 2,134 examinations was to reveal 1,049 positive cases, or an infection of 49.2 per cent. A second examination was then made of the same specimens by our present technique, which will be discussed in detail later and which calls for careful centrifuging of an emulsion of the feces in water as an important step. The result of this second examination was to show 1,277 cases positive, or 59.8 per cent. Thus, there was a difference of 10.6 in the percentages of infection found by the two methods, which, as an element of error chargeable to the direct smear method, indicates that its exclusive use is not desirable.[1]

In the three years which have elapsed since our first organized operations in British Guiana, we have extended our work to Trinidad, Grenada, St. Vincent, St. Lucia, Antigua, Barbados, Tobago, Dutch Guiana, and the Cayman Islands; have examined thousands of persons; and have made a constant effort to develop a microscopic technique which would

[1] See table on page 64 showing results obtained in Trinidad in examining the specimens of 1,434 persons by the two methods.

meet every demand. What measure of success has rewarded this effort may be determined by a perusal of the following pages, in which the details of our laboratory work are set forth.

42. **Standard Technique of Intensive Method.** All specimens collected are brought to the laboratory by the nurses. When a nurse brings in specimens from his district, the chief microscopist receives, counts, and checks them with the census list presented by the nurse, and acknowledges their receipt by initialing the nurse's list. Until they are to be examined, the specimens from each nurse's district are kept on separate shelves in a case prepared for this purpose. When the specimens are ready for examination, the chief microscopist takes those from a single district, and, arranging them on his table or desk,— which should be high enough for him to stand while at work, — records on the microscopic report sheet [1] the data appearing on the top of each specimen container. The chief microscopist has on his table microscope slides, flat wooden toothpicks, and a dropper-bottle containing water. The assistant microscopists are seated at three small tables just behind him. There should be sufficient space between the tables of the microscopists to allow the chief microscopist

[1] See form, pages 132–133.

to pass freely in his inspections to verify the findings of his assistants.

The chief microscopist takes the first specimen recorded on his sheet and prepares three smears from it, each on a 2 x 3 inch slide, using water as a diluent and spreading the smear evenly with a toothpick, which he discards when the third slide is prepared. No cover glasses are used. He then gives one of the smears to each of his assistants, who at once examines it through his microscope. While the assistants are doing this the chief microscopist proceeds to prepare three smears in the same way from the next specimen on his list. If, during the examination of the slides, a microscopist discovers a parasite egg or larva, he attracts the attention of the chief microscopist, who examines, verifies, and records the finding without announcing to the other microscopists what it is. If the first finding is a hookworm egg or larva, the chief microscopist allows this assistant and the others to continue their search only until he has prepared three smears from the next specimen. But if the finding is other than a hookworm egg or larva, the examination continues until the possibilities of the three smears are exhausted.

If all three smears are found negative to hookworm infection, the specimen from which

they were prepared is set aside for centrifuging later. In determining the length of time to be devoted to the examination of each specimen, it should be kept in mind that this first examination need not be exhaustive, because it is not final except for positive results; it is mainly to eliminate specimens representing heavy infection, which, because of the numerous ova present, do not need to be centrifuged for an accurate diagnosis to be made.

43. **Advantages of Standard Technique.** The method set forth above has several advantages worthy of mention: first, as already pointed out, each finding being verified by the chief microscopist before being recorded, individual error is eliminated and our results are protected from harm at the hands of careless, unskilled, or dishonest employes; second, in the interval of several minutes which must occur between the first finding and the end of the period allotted to the examination of each specimen, the three microscopists are busily engaged in further examination of their respective slides, thus increasing the likelihood of corroborative findings and rendering more conclusive our data regarding the incidence of intestinal parasites other than the hookworm; and, third, by giving each microscopist a distinguishing number or letter and by using this instead of a

mark to indicate positive findings on the microscopic report sheet, it is easy to compute at the end of the day the total positive findings of each microscopist, and thus arrive at the relative efficiency of the men.

44. **Modified Technique to Facilitate Process of Examination.** If the above method should prove too slow, as it may in some stages of the campaign when large numbers of specimens are coming in daily, the following modification, which will permit more rapid work and at the same time will not affect the accuracy of the results as to hookworm infection, is recommended.

The chief microscopist, instead of preparing three smears from one specimen, each smear to be examined by a different microscopist, prepares one smear from each of three specimens, giving a smear to each microscopist for examination. In first examinations in localities where there is an average rate of infection corresponding to that in the West Indies, at least two of these three slides will be immediately found positive to hookworm; and these findings, on being verified by the chief microscopist, can be recorded and the examination of other specimens be undertaken at once. It is proposed in this modification that the chief microscopist shall verify every positive finding

as before, but it is not proposed that all three microscopists shall each examine a smear from every specimen. By this modified method the data secured regarding the incidence of parasitic infections other than hookworm are not so conclusive as when the original procedure is followed.

In all instances in the first examination of each person — that is, in examinations before the administration of any treatment — at least two negative smears are considered necessary to determine the need of centrifuging a specimen. By far the greater number of positive findings are made on the first smear examined before centrifuging. A few, however, are made on the second smear. Hence, by examining two smears from each specimen we are sure to reduce to the minimum the number of specimens to be carried through the more complicated and more time-consuming process of centrifuging.

45. **Average Findings on Successive Slides Examined.** The following table shows in detail the average number of positive findings on each slide examined with the technique here set forth:

Table III — Results Obtained on Each Smear Before and after Centrifuging, in Examining Specimens from 1,434 Persons in Trinidad.

(Note: To diagnose the specimens submitted by these 1,434 persons, 4,614 separate microscopic examinations were required.)

	Examined	*Positive*	*Per cent Positive*	*Negative*
Before centrifuging				
First smear	1434	609	42.4	825
Second smear	825	132	9.2	693
After centrifuging				
First smear	693	109	7.6	584
Second smear	584	45	3.2	539
Third smear	539	0	0	539
Total		895	62.4	

46. **Preparation of Specimens for the Centrifuge.** When twenty or more specimens have been found negative in the first examination, they are prepared for the centrifuge. The centrifuge used is a special machine supplied by the Bausch and Lomb Optical Co., of Rochester, New York, U.S.A.[1] It is hand-driven, with two speeds, and has a Stewart panhead carrying twenty tubes. The tubes, of glass, are open at both ends, but are closed with corks when the machine is in use.

The method of preparing specimens for centrifuging is as follows:

[1] For description, see page 176.

(1) On a heavy piece of cardboard 14 x 16 inches in size, preferably with rough or matte surface, twenty 2″ squares are ruled and numbered from one to twenty. If the upper surface of the cardboard can be rendered waterproof by the application of a coat of varnish or oil, it can then be cleaned after use by wiping with an antiseptic solution.

(2) Twenty of the specimens to be centrifuged are arranged on this chart, one in each square. The number of the square in which the specimen is placed becomes the centrifuge number of that specimen and is so recorded on the microscopic sheet. Beginning with specimen No. 1, the following steps are taken in preparing the specimens for centrifuging:

(*a*) The specimen as it rests in the tin container is thoroughly stirred with a wooden toothpick to secure a uniform distribution of ova in the fecal mass. When the specimen is too dry or too firm for this to be accomplished satisfactorily, a small quantity of water may be added.

(*b*) Small particles of feces are lifted with a wooden toothpick from a number of places in the specimen and placed in a flat-bottom glass vial. The quantity of feces used should be from 4 to 5 grams. To this should be added ten or more times its bulk of water. The water

and feces are then stirred and agitated together until an emulsion is formed.

(*c*) This emulsion is then poured into a centrifuge tube through a glass or special paper funnel, in which are placed two or three layers of gauze. The purpose of the gauze is to remove the larger particles from the emulsion. The clips holding the tubes in the panhead of the centrifuge are numbered from one to twenty. The centrifuge tube containing the emulsion from specimen No. 1 on the chart is placed in clip No. 1 in the centrifuge, No. 2 in clip No. 2, and so on. When all twenty of the tubes are in position, the top of the panhead is screwed on. The handle is attached first to the low and then to the high speed shaft, until the desired rate of revolutions is attained. With the centrifuge described, the length of time necessary to throw most of the eggs suspended in the emulsion to the outer end of the tube and deposit them on the cork, is two or three minutes. The time, of course, varies somewhat with the thickness or density of the emulsion. When the process of centrifuging is complete, the tubes, beginning with No. 1, are taken out of the panhead, the cork in the inner end of each tube is removed, and the liquid portion is carefully poured off. Afterwards the outer cork is removed, and from the debris which

is found deposited on it, three slides are prepared and examined by the method previously explained.

47. **Technique of Examination Following Treatment.** As the intensive method aims at writing "cured" after the name of every infected individual in the area of operation, re-examination after treatment, to ascertain whether or not a cure has been effected, is an important step and deserves special consideration. It is in re-examinations, where the number of worms in the intestinal canal has been reduced by treatment and where purgation incident to the treatment has swept out any accumulation of ova, that exceptional care must be taken to guard against misleading negative findings, and it is in this phase of the laboratory work that the use of the centrifuge is most helpful. As the first and each successive treatment reduces the number of worms in the intestinal canal and hence the proportion of ova in the fecal specimens, the number of positive findings possible without the use of a centrifuge is correspondingly lowered. Hence, after two treatments have been administered, it is a waste of time to examine more than one smear from each specimen before centrifuging, while some of the directors dispense with all direct smear examinations after two treat-

ments and make centrifuging the first step of all re-examinations. So few cases of hookworm infection are cured with one treatment that no re-examinations are made until a sufficient interval has elapsed after the second treatment.

48. **Number of Specimens Examined Daily.** A laboratory with four skilled microscopists — that is, a chief microscopist and three assistants — should handle from two hundred to three hundred specimens daily, according to the percentage and severity of infection. Where the rate of infection is low and the disease mild in form, the proportion of specimens requiring centrifuging is higher and progress is correspondingly slower.

VIII

TREATMENT

49. **Thymol Preferred as Anthelmintic.** Although tests of other drugs have been made in the work against hookworm disease in the West Indies, thymol remains the drug of our choice. Two plans of administering it have been tried, — the daily-dose, and the intensive, or weekly-dose, methods.

50. **Daily-dose Method of Administering Thymol.** This method has been successfully used by Dr. J. E. A. Ferguson, District Medical Officer, in treating indentured labor on the sugar estates of Peter's Hall district, British Guiana. It requires that the patient be given a small dose of thymol daily except Sunday until cured. The dose of thymol for the adult is ten grains, and for children proportionately smaller. No purgation and no modification of diet or habits is necessary except abstinence from alcoholics for a few hours after taking the thymol.

In our experiment with this method, we treated 1,876 cases out of a total of 1,918 found infected in a population of 3,207. Thymol distributors visited the infected persons six days in the week and administered the daily dose of thymol. It was not found difficult to

induce most of the patients to begin treatment. In fact, since the examination and treatment were free, many were eagerly responsive to the idea of "getting something for nothing," and all seemed to covet the "certificates of health" which were issued to those who were not infected with hookworms, or which were promised to those who, if infected, would persist in being treated until cured. The fact that this method of treatment did not require the patients to make any sacrifice in diet or habits was a persuasive talking-point in inducing the infected to begin treatment, but this advantage was more than lost when it was learned that thymol was to be given them daily for months.

Our experience with this method continued for nine months, at the end of which the rate of infection in the area where the plan was used had been reduced from 69 to 31 per cent. To accomplish this reduction, 148,821 doses of thymol were given. The amount of thymol necessary for a cure in individual cases ranged from 250 to 2,000 grains.

It was from the prolongation of treatment that most of our difficulties with this method arose: a considerable number became tired of the daily dose and were inclined to abandon treatment, the improvement in physical condition being so slow that often it was not suffi-

ciently apparent to encourage them to continue. During the nine-months' period, unavoidable circumstances — such as absence from home, intercurrent illness, etc. — caused frequent interruptions in the course of treatment, and since the efficiency of this method seems to depend somewhat upon its regularity, this added to the difficulties. Also, the rather elaborate force required for the distribution of daily doses of thymol to a large population, the great prolongation of the course of treatment, and the large amount of thymol necessary to cure the average individual, placed the per capita cost too high for the method ever to be used extensively except possibly where the persons to be treated are under strict control, as in certain public institutions, or, as is the case in treating indentured labor, where a force already in existence for other purposes may be employed to distribute and administer thymol.

51. **Intensive, or Weekly-dose, Method of Administering Thymol.** This is the method used almost exclusively throughout the West Indian colonies. It provides that the patient be given a dose of thymol on one day of each week until he has been cured. The dose is based upon sixty grains as the maximum for an adult, and is preceded and followed by an

active saline purgative, the patient being required to abstain from food for at least eighteen hours during the treatment.

When the medical director visits the infected people in their homes before they are treated, he subjects each of them to a thoracic examination with the stethoscope and by percussion, and observes their clinical aspects. The information gained by this examination enables him to prescribe the proper course of treatment and dosage for each individual and to eliminate those medically unfit for treatment.

52. **The Medically Unfit for Treatment.** Persons medically unfit for treatment include those suffering from acute diseases, such as malaria (febrile stage), fevers of any type, diarrhea, dysentery, gastritis, etc.; those having chronic dysentery or diarrhea, organic cardiac or renal disease, pulmonary tuberculosis beyond the incipient stage, or general anasarca; those who are extremely weak or feeble from old age or from other cause; and pregnant women, or women with serious hemorrhagic diseases of the uterus. Patients having these complications should not be treated for hookworm disease, except possibly under hospital conditions.

53. **Directions for Taking Thymol.** The following directions are given to each patient to be followed in taking treatment:

(1) At 5 or 6 P.M. on the day preceding the treatment take a cathartic dose of sulphate of magnesia. No supper should be eaten. The saline should thoroughly empty the alimentary canal.

(2) Remain in bed the following morning without food, and at 6 A.M. take one-half of the thymol. At 8 A.M. take the remainder.

(3) Take a cathartic dose of sulphate of magnesia at 11 A.M. This should be repeated if a thorough movement of the bowels is not secured within two hours.

(4) No food should be taken until after the bowels have moved thoroughly, and then no greasy foods or milk should be taken, or alcoholic drinks indulged in.

(5) The usual diet and habits may be resumed on the day following the treatment.

(6) If a feeling of weakness or dizziness arises during treatment, take one-half cup of strong black coffee without sugar or milk.

(7) Careful examination of the dejecta from the second dose of sulphate of magnesia will show the dead worms.

There is a scientific reason behind each step of the treatment as detailed by these directions, which must be evident to the mind of the medical man familiar with the disease. Since hookworm is a disease which will not yield to

haphazard medication, some cases proving obstinate under any method of treatment, and since thymol is a drug which must be given under certain restrictions in order to be safe and efficient, it is well to have definite directions to follow in its administration.

54. **Interval between Treatment with Thymol and Re-examination.** Early in the dispensary work in the Southern States the plan of giving thymol treatment every week was adopted, and in the main has been adhered to since. This practice requires that all re-examinations be made on the seventh day after treatment. This interval of seven days between treatment and re-examination is probably not of sufficient length to place above suspicion *all* negative findings so recorded, inasmuch as the female worms not expelled by the treatment are to greater or less degree subjected to the toxic effects of the thymol, and cease egg-bearing for an undetermined length of time. Hence, absence of ova from fecal specimens collected from a patient too recently treated is not conclusive evidence of cure.

To ascertain the proper interval between treatment and re-examination where thymol is used, several of our medical directors have examined a series of cases at different intervals after treatment. These investigations have es-

tablished the belief that very few cases found negative on the seventh day after treatment with thymol will be found positive if re-examined at the end of a longer interval. The fact that a small percentage will, however, has led certain of the medical directors to obtain a second specimen for re-examination seven days after the first negative specimen was obtained, and to pronounce no patient cured until at least two specimens — one obtained seven and the other fourteen days after the latest treatment — have been found free of ova.

55. **Number of Thymol Treatments Necessary to Cure.** Several of these courses of thymol given at weekly intervals are usually necessary for a cure. Where the alimentary canal is thoroughly cleared out by salines before the administration of the thymol, and the patients abstain from food and receive the second dose of saline at the proper time, we have a right to expect 50 per cent of the cases to be cured with two treatments. In our four years' experience in the West Indies any marked decrease in this percentage has invariably meant either faulty preparation of the thymol or its improper administration. This means that about half our cases are cured with two treatments, or in eight days after the first examination. Only a small percentage require more than three treatments.

Almost any person who is convinced that he harbors hookworms in his body will readily consent to give one day of each week for two or three weeks to be cured of this malady.

56. **Is Thymol a Dangerous Drug?** It has often been stated that the above mentioned dose of thymol is dangerous. In reply to this, I point to the fact that more than a million maximum doses of thymol have been administered in the United States, and several hundred thousand similar doses in our work in the foreign fields, to persons of every age, color, race, and physical condition, and that many of these treatments early in our work were taken by the patients in their own homes without supervision from nurse or physician, and yet without fatality or serious physical disturbance of any kind, except in a very limited number of cases where the patients indulged in alcoholic drinks or failed to follow directions in some other important detail. It is extremely probable that in a large number of cases the thymol was incorrectly taken, for many of the people were illiterate and otherwise densely ignorant. I fancy there are few drugs in the pharmacopoeia which could stand so severe a test with so few instances of serious toxic symptoms.

57. **Preparation of Thymol for Administration.** Observations were made by Dr. B. E.

Washburn, Medical Officer in Charge of the Ankylostomiasis Campaign in Trinidad, British West Indies, on the use of thymol alone and in combination with different proportions of sugar of milk. The results of this investigation were as follows:

(1) Three hundred and twenty-five patients were treated with pure thymol, finely powdered and encapsulated; 41, or 12.6 per cent, were cured with two treatments.

(2) Three hundred and fifty cases were treated with a supply of thymol already mixed with sugar of milk and encapsulated by the manufacturer. The thymol was not so finely powdered, and was combined with the following proportions of milk sugar:

10 grains thymol to 2½ grains milk sugar;
5 grains thymol to 5 grains milk sugar;
2½ grains thymol to 2½ grains milk sugar.

Most of the treatments consisted of doses of the first proportion, i.e., 10 grains thymol to 2½ grains milk sugar. Of the 350 cases treated with this mixture, 76, or 21.7 per cent, were cured with two treatments.

(3) One thousand one hundred and twelve cases were treated with finely powdered thymol mixed with equal parts of milk sugar; 546, or 49.1 per cent, of these cases were cured with two treatments.

These results are presented in summary form below:

Agent used	*Per cent of cures with two treatments*
Finely powdered thymol	12.6
Thymol with less than equal quantity of milk sugar	21.7
Thymol with equal quantity of milk sugar	49.1

The dosage of thymol and the method of administration were the same in every instance. All medicine was administered by trained attendants, who kept the patients under observation during treatment. Although Dr. Washburn's experiments did not deal with numbers sufficiently large to make his results conclusive, his findings have nevertheless been fully substantiated by other experiments of a similar nature since made by the medical directors of campaigns in other colonies, those of Dr. F. E. Field in British Guiana deserving special mention.

Evidently thymol, when combined with an equal quantity of milk sugar and the two thoroughly triturated together, is much more effective than when given alone or in a granular state. This is likely due to the fact that in this combination the thymol remains in a state of fine division until liberated in the stomach, and thus, being more uniformly distributed throughout the bowel contents, comes more intimately into contact with a larger proportion of the worms in the bowel.

58. **Toxic Effects of Thymol.** Thymol is an irritant to the mucous linings of the stomach and intestine, but seemingly only to a very slight degree when those membranes are normal and healthy. With acute, sub-acute, and chronic diarrhea and dysentery, and related troubles, the use of thymol is contraindicated because its effect upon the already inflamed mucous membranes of the alimentary canal is to aggravate the inflammatory processes, much to the discomfort and harm of the patient.

Except in the case of a very few persons who, because of an idiosyncrasy, cannot safely take even a small dose of thymol, serious toxic symptoms develop from its use only when it passes into solution in the stomach or intestine and is absorbed into the blood current. It is said to be only slightly soluble in the normal gastric and intestinal juices, and it is this fact which enables us to give it, without harm to the patient, in the comparatively large doses necessary to expel the hookworms.

Thymol is soluble in oils and fats, and very soluble in alcohol and its dilutions. The presence in the intestinal canal of either oils, fats, or alcohol along with a large dose of thymol will often, but not invariably, lead to the development of toxic symptoms. Furthermore, if the dose of thymol used in the treatment of

hookworm disease is allowed to remain in the alimentary canal indefinitely, a more or less gradual absorption of the drug may take place, and the patient will develop toxic symptoms.

The toxic effects of thymol may be classed under two heads, according to the degree of intoxication: minor symptoms, and serious symptoms.

59. **Minor Symptoms of Thymol Poisoning.** The minor symptoms include:

(*1*) *Muscular weakness and lassitude.* Most often these are due to the patient's abstaining from food during the treatment and to the effect of the cathartic doses of magnesium sulphate. Usually, except in the very young and very old, these symptoms, when manifested alone, are negligible.

(*2*) *Vertigo, or giddiness.* This is usually attributed to the absorption of the thymol into the blood current, with its resultant effect upon the cerebral centers. A certain percentage of the patients treated with thymol experience slight vertigo during the treatment, which is relieved immediately when the patient assumes a reclining position, and disappears entirely when the cathartic, which should always follow the administration of thymol, has emptied the intestinal canal.

(*3*) *Gastric and intestinal irritation.* This is

usually manifested by a feeling of heat or burning in the esophagus and stomach, and by colicky pains in the abdomen. These symptoms are most often of a transient nature, not requiring any special effort at relief. In a small percentage of cases, when the gastric irritation does persist, relief often may be had by giving the patient a glass of soda water (one teaspoonful of baking soda in a goblet of water). If this does not accomplish the desired result and the distress of the patient is severe, one or more tablespoonfuls of milk of bismuth, diluted with twice its quantity of water, will afford relief.

(4) *Nausea* sometimes follows the administration of thymol. This is especially true where the preparatory dose of magnesium sulphate is still active when the thymol is given. By keeping the patient quiet and in a recumbent position, vomiting rarely occurs to the extent of interfering with the course of treatment.

60. **Serious Symptoms of Thymol Poisoning.** When serious symptoms appear, they manifest themselves in several or all of the following phenomena:

Vertigo has been mentioned already as a minor symptom, but in proportion as it increases in degree, accompanied by other disturbing symptoms, it indicates further and

increasingly dangerous absorption of thymol into the blood current. It is usually accompanied by headache, by tinnitus, and by disturbances of vision. At first the pulse rate is slowed, but later it may become rapid, thready, and weak. Respiration is slowed, and later may assume a sighing, or Cheyne-Stokes, character. The lips and finger tips become blue. The face is pale and anxious, and may be bathed in a clammy sweat. At this stage there is a decided fall in the body temperature, and the clinical picture is very similar to that of surgical shock or collapse. The patient usually suffers with delirium, and unless reaction takes place here, the cyanosis increases, the circulation and respiration are further depressed, the patient passes into a condition of complete coma, and dies.

61. **Treatment of Thymol Poisoning.** For the milder forms of toxic symptoms — i.e., muscular weakness, vertigo, slight cyanosis, and slowing of pulse rate and respiration, — either no intervention is necessary or the following simple measures suffice:

(1) Put the patient to bed and give a cup of strong, hot coffee without sugar or milk.

(2) If possible, empty the bowel with a high enema of warm water, or of Senna and salts solution.

(3) If the enema does not immediately produce satisfactory results and relief does not immediately follow, give a full cathartic dose of Epsom salts, or of any other active saline, in hot water.

(4) Do not at this or at any other stage give castor oil as a purgative, or alcoholics by the mouth as a stimulant.

In cases where collapse has already come or seems imminent, resort should be had to more powerful stimulants administered with a hypodermic needle. These stimulants, in the probable order of their usefulness in such emergency, would be: Morphia, 1/6 gr., with 1/150 gr. Atropine; Strychnine nitrate, 1/30 gr.; Nitroglycerin, 1/100 gr.; or Digitalin, 1/100 gr. (Adult dosage). The patient should be wrapped in blankets and be kept warm with hot-water bottles until reaction takes place. No effort should be spared to empty the bowel thoroughly, and by so doing to stop further absorption of the thymol.

The recovery of a patient from even the more severe degrees of thymol poisoning is very rapid, and secondary symptoms, if they develop, may be treated symptomatically. Unsuspected organic weakness or disease may accentuate any one or several of the above mentioned symptoms. It should not be over-

looked, furthermore, that to thymol are attributed certain powers as an abortifacient in pregnancy, and for this reason it should be given only under proper conditions and with proper precautions when this condition exists.

62. **Use of Oil of Chenopodium as an Anthelmintic.** Although in recent years oil of chenopodium has been growing in favor as a remedy for hookworm disease, the experiments with this drug which have been made in the West Indian colonies have in no instance led to its general use. Various methods have been recommended for its administration, the chief of which are summarized below.

63. **Schüffner and Vervoort Method of Administering Chenopodium.** In this method of treatment by chenopodium, 16 drops of the drug are administered every two hours for three doses. Two hours after the last dose, 17 grams of castor oil, with 3 grams of chloroform dissolved in it, are administered. It is said that the addition of the chloroform to the castor oil is not strictly necessary, but that it does no harm and increases the percentage of cures. No preliminary purge or restrictions in diet are required. The oil of chenopodium may be given either on sugar or in sealed capsules. The dosage for children is in proportion to body weight rather than to age by years.

64. **Weiss Method of Administering Chenopodium.** Dr. Weiss, of Sumatra, states that the following method of administration is employed advantageously with the labor on the rubber estates of Sumatra:

At 1 P.M., just after the midday meal, 16 drops of oil of chenopodium are administered. At 2 P.M. and again at 3 P.M., similar doses of 16 drops are given. At 4.30 P.M., 20 grams of castor oil are given, after which the laborer returns to his quarters. No dietary restrictions are practised, nor is a preliminary purge given. The oil of chenopodium is administered in capsules freshly prepared. In the presence of a high rate of infection and of conditions which favor re-infection, it is the routine practice to administer this treatment twice yearly to all laborers, without microscopic examination or re-examination except in certain instances.

65. **Method of Administering Chenopodium Recommended by Uncinariasis Commission to the Orient.** The report of the Uncinariasis Commission to the Orient contains a valuable contribution to our knowledge of chenopodium and its use in treating hookworm infection. This Commission recommends as the routine treatment for hookworm disease, 1.5 centimeters of oil of chenopodium divided into three

equal doses and administered at hourly intervals, the first at 7, the second at 8, and the third at 9 A.M. It believes in giving a light evening meal, followed by a purgative dose of magnesium sulphate, and a very light breakfast, consisting of milk or konje, on the morning of treatment. At 11 A.M., two hours after the last dose of chenopodium has been taken, a purgative dose of magnesium sulphate is again administered. Treatment should not be repeated in less than ten days. After considerable research this Commission concluded that magnesium sulphate is a safer and more efficient purgative to use with chenopodium than castor oil, which had formerly been so extensively recommended.

The section of their report dealing with this subject has been published in an article entitled "The Treatment of Hookworm Infection," which appeared in the Journal of the American Medical Association.[1] In this article the relative value of thymol and chenopodium, and the after-effects produced by the use of these drugs, are compared. For the benefit of readers who may not have at hand the full treatise, which was based on a series of 123 cases treated with thymol and seventy-nine

[1] February 23, 1918, vol. 70, pages 499–507. Complete reprints of this article will be sent to all interested persons upon application to the New York office of the International Health Board.

treated with chenopodium, the following summary of the conclusions reached by this Commission is appended:

"It would appear from the comparisons given that the half maximum dose (0.5 c.c. three times, or 1.5 c.c.) of oil of chenopodium is the treatment for recommendation as a routine vermicide.

"It does not have the toxic effects of the full dose, and two treatments have the very satisfactory result of removing 99 per cent of all worms present.

"It has the additional advantage of a more uniform action, a greater effect on ancylostomes, and of being less unpleasant to take than thymol.

"Thymol shows an advantage over this half-maximum dose of oil of chenopodium in that the 90 grains' dosage produces a better result when single treatments are compared. This advantage disappears, however, when two half-maximum treatments of oil of chenopodium are given.

"Smaller doses compare unfavorably with a single half-maximum dose of oil of chenopodium. A dose as large as 90 grains of thymol, if administered indiscriminately throughout the population, would probably give rise to serious symptoms."

66. **Interval between Treatment with Chenopodium and Re-examination.** Certain directors who have used chenopodium extensively report that it inhibits the egg-bearing function of the female hookworm much longer than thymol, and that for this reason a minimum interval of fourteen days should be allowed to elapse

between the treatment of a case with chenopodium and re-examination. We have seen that the Uncinariasis Commission to the Orient recommends at least ten days. The directors of work in certain countries allow a similar period to elapse. It was shown, however, by Washburn and by Colwell in their experiments with chenopodium in Trinidad and in Grenada, that even with an interval of fourteen days between treatment and re-examination, there still exists a very material element of error in the negative findings.

67. **Preparation of Chenopodium for Administration.** The fact that flexible gelatin capsules do not keep well in tropical climates has led to the practice of giving oil of chenopodium on sugar. This also has its disadvantages. Recently, the ordinary hard, or shell, gelatin capsules have come into use for administering this drug, and are proving quite satisfactory. They are prepared as follows: the required number of minims of oil of chenopodium is placed in the long end of the capsule; the edges of the cap portion are moistened on the inside with water, using a fine camel's-hair brush; the capsule is then closed and the cap portion forced firmly down. To allow the cap to dry in position, the capsules are placed in a rack in an upright position for fifteen minutes. Care

should be taken to get no oil on the outside of the long end of the capsule, as otherwise the cap will not adhere properly and the oil will leak out. When the capsules are dry they should be kept in an air-tight container, into which, for its drying properties, a small quantity of lycopodium powder may be dusted.

68. **Measurement of Oil of Chenopodium.** Chenopodium is usually measured either by the drop or by the minim. In testing the relationship of the drop to the minim we find that no two droppers, even of apparently the same make and size, give the same proportion of minims to drops in a cubic centimeter. The slightest variation in the calibre of the tip of the dropper, of the position in which the dropper is held, of the weight of the fluid column in the dropper barrel, of the temperature of the oil, or of the specific gravity of the oil (which varies considerably in different samples), renders the drop a most uncertain quantity. Medical directors should be specially cautioned not to use the drop as a unit of measure.

69. **Toxic Effects of Chenopodium.** The writer has recently had brought to his notice a considerable number of cases of chenopodium poisoning, only a few of which have yet appeared in medical literature. These cases, which unfortunately have not been free from

fatalities, have occurred in the Southern States, the West Indian colonies, Panama, Nicaragua, Ceylon, Egypt, and Brazil. In nearly every case the oil of chenopodium was administered by one of the accepted methods of treatment and in less than the maximum dose (of 3 c.c.).

In most of these cases the alimentary canal was kept as nearly empty as possible for the period of treatment, by restrictions in diet and by purgation; and magnesium sulphate was used as the purgative. This is significant in view of the following statements by Salant and Nelson:[1]

"The toxicity of chenopodium is distinctly increased in starvation and is decreased by feeding oils and by feeding a rich carbohydrate diet . . ."

"The increased toxicity of chenopodium in starvation and its cumulative effect are important factors, as shown in our experiments in determining its toxicity. It is quite possible that the reason there are so few cases of poisoning in the literature is that castor oil has been administered immediately after chenopodium, which is quite likely to exert an antidotal effect on the drug."

Attention should be called, however, to the fact that these conclusions of Salant and Nelson do not agree with the experience of the Uncinariasis Commission to the Orient, which

[1] Toxicity of Oil of Chenopodium, by Salant and Nelson, Reprint from American Journal of Physiology, Vol. 36, No. 4.

found that persons who had taken castor oil "always showed the greater number of cases of dizziness and deafness, most of the cases of inability to rise and walk occurring in this group." This Commission reported also that "dizziness and muscular incoördination were less marked with magnesium sulphate than with castor oil."

It is reported that in Sumatra several hundred thousands of doses of chenopodium have been administered by the method described on page 85 without the development of toxic symptoms. It is interesting to note that this method does not require restrictions in diet; that the persons dealt with normally subsist on " a rich, carbohydrate diet"; and that "castor oil is administered immediately after the chenopodium." The fact that the treatment is given without preliminary microscopic diagnosis and without microscopic re-examination to ascertain if those treated have been cured, however, makes uncertain its efficacy in curing the patient, although it is said to cause marked improvement in physical condition.

70. **Symptoms of Chenopodium Poisoning.** These symptoms seem to group themselves under two heads: (1) Gastro-intestinal symptoms and (2) Neuro-toxic symptoms:

(1) *Gastro-intestinal symptoms:* In many cases

where oil of chenopodium is administered there is evidence of irritation to the mucous lining of the stomach and intestine, manifested by a sensation of heat or burning in the stomach and by colicky pains which may continue for several days. Nausea and vomiting are sometimes present. As a rule, the gastro-intestinal symptoms are not severe and need give rise to no alarm, but in three cases reported recently from one of the Southern States these symptoms developed rapidly, violent retching and purging occurred, and the patients collapsed and died, apparently without any marked involvement of the central nervous system or other evidences of absorption of the drug.

(2) *Neuro-toxic symptoms:* Many patients to whom oil of chenopodium has been given complain in a few hours of tingling or numb sensations in the extremities. These symptoms may persist for several days, often causing the patient much discomfort and uneasiness. The more severe neuro-toxic symptoms — consisting of headache (usually frontal), vertigo, tinnitus aurium, deafness, muscular weakness, muscular incoördination, localized muscular spasms, delirium or mental incoherence, convulsions, and coma — rarely develop in less than from twenty-four to thirty-six hours after the drug has been taken, and have been known to be

delayed until the third day after treatment. In most fatal cases reported, these symptoms have developed in the order given, the patient dying in deep coma after a severe convulsive attack.

The aural phenomena produced by chenopodium poisoning are very constant, and often persist for a long period after other symptoms have subsided. Dr. Samuel Seiton of New York reported three cases in which the "anomalies of audition" were very marked. He inferred "that the medicine had a somewhat specific effect on the middle ear," and spoke of the vertigo as being of auditory origin.[1]

71. **Treatment of Chenopodium Poisoning.** Salant and Livingston state that chenopodium depresses the heart's action, causing a marked fall in blood pressure, and that it also depresses the respiratory centers, with resulting decrease in the rate and amplitude of respiration. The character of its toxic symptoms indicates also that it produces a cerebral congestion and has a somewhat selective action on the auditory mechanism.

On the development of symptoms of poisoning by chenopodium, a dose of castor oil should be administered at once, and should be re-

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[1] American Journal Otology, Vol. 2, 1880, Aural Phenomena of Chenopodium Poisoning, S. Seiton, M.D.

peated, if necessary, until the alimentary canal has been thoroughly cleared. This first measure is advisable not alone because it clears the alimentary canal of the drug and prevents further absorption, but also because of the antidotal properties which are attributed to castor oil.

The cardiac symptoms may be met with digitalin, preferably administered subcutaneously. The convulsed condition often met with in these cases does not necessarily contraindicate strychnia in small doses as a respiratory and general stimulant. In collapse, the application of heat to the body and other restorative measures may be employed.

That oil of chenopodium will ultimately occupy an important place as a vermifuge is evident to all who have used it for this purpose. It is also evident, and becoming more so with increasing experience, that it is a powerful poison, often uncertain in action with our present dosage and methods of administration. To render it safe and efficient as a therapeutic agent, more knowledge must be had as to the proper method of its preparation, as to its chemical composition and stability, and as to its proper dosage and method of administration.

IX

SANITARY MEASURES FOR PREVENTION

72. **Necessity of Preventing Soil Pollution.** As the whole question of preventing the spread of hookworm disease is one of guarding against the deposit of ova-impregnated feces on the surface of the ground, where the eggs can hatch and develop into infective larvae, the problem of establishing an adequate and satisfactory system for the disposal of night soil becomes of paramount importance. In the West Indian colonies this feature of the work is entirely in the hands of the local governments. The Board undertakes merely to locate and to cure, so far as this may be possible, every person infected with hookworm disease in the areas of operation, and to educate all of the people — through literature and illustrated lectures, and by other means — in ideas of modern sanitation and disease-prevention.

73. **How the Sanitary Problem is Defined.** The sanitary problem of an area of operation is determined by a house-to-house survey of latrine conditions, and the object in sanitation has been accomplished when every house has been provided with adequate latrine accommo-

dations and when a system of inspection has been established to guarantee their proper use. The sanitary work, which must be kept under a system of permanent inspection, is carried out by permanent government agencies. Where no sanitary organization exists, the intensive work enables the government to undertake a definite sanitary task on the basis of an insignificant outlay and to develop its sanitary organization gradually, as the work is extended from area to area and as the people are educated to the point of giving willing and intelligent co-operation.[1]

The International Health Board does not undertake to advise as to the definite type of latrine to be installed in these areas of operation in the West Indies. The department of health in each country is responsible to its people for all sanitary measures carried out under its direction, and must, therefore, use its own judgment as to the type of latrine recommended.

74. **Types of Latrines to Prevent Soil Contamination.** In most instances the pail or pit type, or both, have been adopted. The pail type, under controlled conditions and with proper disposal of the night soil, is safe; but practical experience in rural communities has

[1] See Second Annual Report, International Health Board, p. 22.

demonstrated that it frequently becomes offensive and falls into disuse, and that extreme difficulty is experienced in keeping the boxes fly-proof and in having the pails properly cleaned. Where the contents of the pail are buried in the soil, this must be done according to careful government regulation, else many consequences may result to defeat the original purpose of the effort.

The pit latrine, which has been installed in large numbers in most of the West Indian colonies, has the advantage of being inexpensive, simple in construction, and almost automatic in operation. It has come into extensive use mainly because it is practical and the people can be induced to install and to use it. Where there are no latrines and soil pollution is the rule, and where the level of the ground water is such as will permit of serviceable pits being dug, the introduction of the pit latrine is a vast improvement, not alone for controlling the spread of hookworm disease but for reducing the occurrence of other excrementitious diseases as well. One should remember, however, that its use involves a large accumulation of excreta underground, with whatever this condition implies as to the danger of water contamination by seepage and underground drainage.

The finding of a satisfactory method for the

disposal of sewage at the rural home, one which the people may be brought to adopt and to carry out, and which will prove to be safe in actual experience as well as in theory, is a problem yet to be solved.

X

PER CAPITA COST

75. **Importance of Cost Element.** In considering any plan or scheme which contemplates an attempt at the relief or control of disease — or, in fact, any undertaking of a public or of a philanthropic nature — the item of cost, except possibly in great emergencies and under special conditions, must receive careful attention. The more extensive the field to be covered, the more important becomes this question of the cost of the enterprise.

In our campaigns in the West Indies, the item of cost has received special attention, since these efforts are intended to serve as demonstrations which, by proving the feasibility of attaining the object in view at a non-prohibitive cost, will lead to the establishment of permanent agencies to continue and enlarge the working program.

76. **How "Per Capita Cost" is Figured.** When a given piece of work is finished, or at the end of a calendar year, it is desirable to have some index of cost for the year or for the completed work. This index is expressed as the per capita cost of examination, of treatment, or of cure. The index is reached by the simple

process of dividing the total budgetary expenditures of the campaign by the number of people examined, by the number of people treated, or by the number of people cured, as the case may be. While this is called "per capita cost" for want of a better term, it is understood that it is not the actual per capita cost of any one of these three features of the work, but only an index of cost which for purposes of comparison is sufficient. From these indices one gains a rather clear idea of the efficiency of a campaign from the standpoint of cost. It should, however, be kept in mind that no numerical expression can be given to the far-reaching and permanent educational results of successful intensive work. These results can find expression only as the awakened interest and concern of the people lead them, in the future, to protect human life from the baneful effects of disease.

77. **Cost Indices of West Indies Intensive Work.** The following table shows the cost indices of the campaigns in the West Indies for the period of four years, 1914–1917. It should be noted that the tendency has been downward in spite of the great advance in the cost of medical supplies, of scientific apparatus, and of ocean freights, and the fact that in several instances we are operating in less populous

Table IV. — Cost Per Person Examined, Treated, or Cured in Intensive Work in the West Indian Colonies During Period 1914–1917, Inclusive

Colony	Total expenditure divided by number of persons examined					Total expenditure divided by number of persons treated					Total expenditure divided by number of persons cured
	Average for all years	1914	1915	1916	1917	Average for all years	1914	1915	1916	1917	Average for all years
All Colonies.....	**$1.16**	$1.02	$.69	$1.47	$1.22	**$2.13**	$1.93	$1.61	$2.25	$2.13	**$2.65**
Antigua..........	**.85**	...	.90	1.42	.47	**6.00**	...	4.02	5.50	9.33	**6.31**
British Guiana....	**1.02**	1.02	.45	2.30	1.56	**1.90**	1.93	1.27	2.24	2.36	**2.41**
Dutch Guiana....	**1.87**	...	1.40	1.35	2.62	**2.21**	...	1.80	1.71	2.82	**2.51**
Grenada.........	**1.97**	...	...	3.89	1.19	**3.28**	...	...	5.05	2.25	**4.32**
St. Lucia.........	**1.04**	...	.76	1.05	1.49	**2.07**	...	1.47	2.86	2.32	**2.81**
St. Vincent.......	**1.04**	...	.91	1.14	1.04	**1.97**	...	2.75	1.90	1.75	**2.21**
Trinidad.........	**1.13**	...	1.11	1.77	.76	**1.73**	...	1.76	2.67	1.16	**2.30**

areas. This decrease in cost is probably due to improvement in methods, to greater efficiency of the field forces, and to more perfect co-operation of the public. It is obvious that the per capita cost of treatment and of cure will be higher in those colonies having light infection: Antigua exemplifies this fact in the accompanying table.

XI

CONCLUSION

78. **Wide Applicability of Intensive Plan.** The experiences of four years in the West Indies have demonstrated that the intensive plan of work is feasible under a great variety of conditions, and strongly suggest its applicability under all conditions, irrespective of race, creed, occupation, environment, distribution of population, or degree of infection. Successful work has been done in areas where five different languages were spoken, and where East Indians, negroes, Chinese, Portuguese, and creoles of English, Spanish, and French blood, with a great variety of mixed breeds, made up the population. The distribution of population has varied from the densely inhabited villages of British Guiana and Trinidad to the scattered and almost inaccessible rural homes of St. Vincent, where, in one instance, with a donkey to ride, a nurse could visit only two homes in a day.

It is remarkable that in the sparsely settled areas, where travel and the distances between homes render the duties of the nurses so difficult, the per capita cost has not been unduly increased. When we consider that the dangers

of re-infection are, from natural causes, much less in sparsely settled sections than in more densely populated areas, where it is correspondingly more difficult to secure adequate sanitary precautions against soil pollution, it would seem reasonable to expect that in the sparsely settled sections total eradication will be earlier and more easily reached.

While agriculture is the principal industry of the peoples involved in these campaigns, yet a variety of other vocations has had representation among those treated, and all classes and walks of life are included, from a judge of the supreme court to the humble "squatter" on crown lands.

Certainly climatic conditions have not favored the purposes of the work, for in all instances we have operated under the conditions common to tropical countries, which are recognized as most favorable to the spread of hookworm disease. What degree of success we have been able to obtain under these adverse and varied conditions is fully set forth on pages 121 and 122.

79. **Educational Value of Intensive Measures.** The educational value of a demonstration against hookworm disease is often largely determined by the thoroughness, scientific accuracy, and efficiency of the methods used, and

is enhanced in proportion as we more nearly accomplish complete control of the disease. In any area of operation the more intelligent classes, consisting of professional men, officials, clergymen, schoolmasters, and plantation owners and managers, whose co-operation is so vital to the success of the work, are quite capable of appreciating the difference between thorough and efficient methods and the successful handling of the problem, and the opposite; and even the less intelligent and the illiterate are not insensible to the painstaking care and attention given them individually and collectively in the effort to cure and protect them from a disease the seriousness of which they soon come to understand.

The requirement of the intensive method that every home be visited by the physician in charge, for the purpose of examining the persons to be treated before the drug is administered, and the subsequent weekly visits of the nurses to give treatment, establish a bond of sympathy and interest which in most instances continues until cures are effected.

80. **Intensive Method as Means of Gaining Good-Will of Populace.** One of the most valuable features of the intensive method is that it gives the people a minimum of inconvenience and annoyance in examination

and treatment. Everything is done for the patient that can be done. His convenience and welfare are made the first consideration. The nurses mark and leave with him a specimen container; they call for the specimen; they report to him the result of the examination. If he is infected, the medical officer calls upon him, and, after examination, prescribes a dose of thymol and a course of treatment to be carried out by the nurse in the patient's own home on the day of the week best suited to his convenience. He is not asked to leave the familiar surroundings of his home to make repeated trips to some central point or hospital, which often to his simple mind is a place of terror and unknown danger. No essential step of the process, from the recording of his name in the census to his discharge as cured, is left to fortuitous circumstances or his own initiative. Although no compulsion is used, he is not asked or expected to exercise discretion in a matter in which manifestly he can have but poor discretion. The attitude of confident expectation of full co-operation which the staff maintains toward the patient goes far toward assuring the needful co-operation.

Dr. Washburn, in commenting upon his experiences with the intensive method of campaigning in Trinidad, British West Indies,

says:[1] "While the primary intent of the intensive method is the control and approximate eradication of hookworm disease, beyond this is the purpose that the results of this work shall demonstrate in a striking and convincing way the possibilities of a direct and definite attack on disease in general when both remedial and preventive measures are brought into play. . . . In working out these objects [the examination of all the people and the treatment and cure of the infected], many opportunities are afforded for demonstrating to the people the chief factors involved in the pollution of the soil and in other health problems. In fact, the chief aim of the intensive campaign is educational. We endeavor to give the people an object-lesson in sanitation, to teach them the basic facts underlying the spread of diseases due to soil pollution. The people and the government may be shown that it is possible to conduct a campaign against hookworm disease in a definite area, with the result of greatly lessening the amount and the severity of the infection and of measurably approaching the complete eradication of the disease.

"We believe that this demonstration has been impressive, and will lead to permanent

[1] Report of Dr. B. E. Washburn, Medical Officer in charge of Ankylostomiasis Campaign in Trinidad, for the year 1915.

results because of the fact that we have attempted to do only one thing, and have accomplished this in a definite manner. To teach a country the story of hookworm disease in all its details and to show it objectively that it is possible for this disease to be effectively dealt with, is much better than to attempt spasmodically to demonstrate the importance of a number of problems of public health."

The medical director in British Guiana, Dr. F. E. Field, in his report of November 18, 1914, in commenting on the very successful intensive campaign completed in the Peter's Hall district, says: "All work recorded in this report has been carried on without interfering with the people's daily work;" and continues, "It is gratifying to report that the local authorities of the various villages of Areas A and B in Peter's Hall district have so thoroughly realized the benefits obtained from the expulsion of the hookworm and have come to understand so well the principles of re-infection and the necessity of preventing it, that they have subscribed the necessary amount to maintain a sanitary inspector to devote his full time to their district."

In conclusion, then, we may say that correct methods of conducting the work inspire confidence; that confidence insures co-operation;

and that co-operation brings results satisfying not alone in the cure of the infected, but in the stimulation among the people of intelligent interest in all questions pertaining to their health and physical well-being.

ILLUSTRATIONS



Fig. 1. Opening of Intensive Work Against Hookworm Disease in British Guiana, April 6, 1914, at Agricola Village, Demerara



Fig. 2. Staff for the Relief and Control of Hookworm Disease in British Guiana



Fig. 3. Staff for Relief and Control of Hookworm Disease in the Tunapuna Area, Trinidad



Fig. 4. Nurses taking treatment to the patients in their homes. St. Vincent



Fig. 5. Rear view of *Fig.* 4 showing method of carrying drugs and equipment

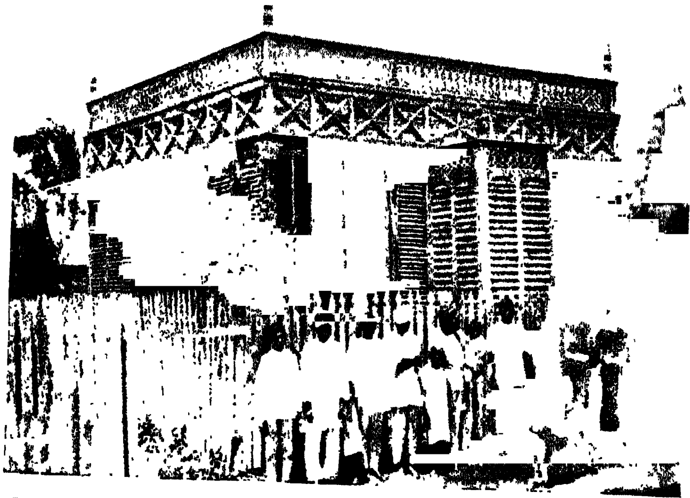


Fig. 6. Group of Mohammedans, all infected with hookworm disease. Mosque in background. British Guiana



Fig. 7. Mohammedan bishop and family. All cured of hookworm disease. Trinidad

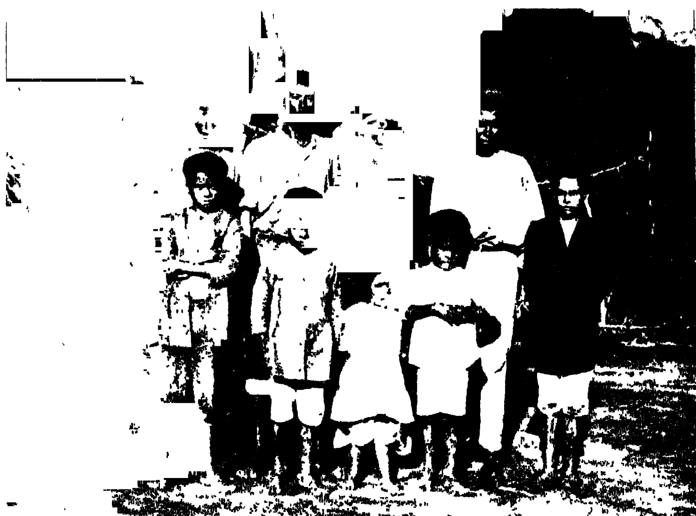


Fig. 8. A family group. All infected with hookworm disease; all treated. St. Vincent



Fig. 9. Company of soldiers. Eighty-two per cent infected with hookworm disease. Cured in one month. St. Lucia

APPENDICES

I

RESULTS ACCOMPLISHED

Table V on page 122 shows the degree to which our campaigns in the West Indies during the years 1914–1917 inclusive have approximated the complete relief and control of hookworm disease in the respective colonies.

By consulting this table, it will be seen that the per cents opposite the line "Remaining in Area Uncured," as based on the number of persons originally infected, run from 8.0 per cent in Dutch Guiana to 26.1 per cent in St. Lucia, with a general average of 16.9 per cent for the seven colonies represented. With an average of only 16.9 per cent of the original infection remaining in these areas, with the people thoroughly understanding the methods by which the disease is contracted and prevented, with the installation of latrine systems which with continuous government supervision should become increasingly effective, it would seem reasonable to expect that, without a second campaign of treatment, the eradication of the disease in the different areas will be attained by the operation of preventive measures and by the self-limiting character of the infection in the individual.

Table V. Results accomplished in the Treatment of Hookworm Disease by the Intensive Method in the West Indian Colonies During the Years 1914 to 1917, Inclusive

	Total for West Indies		Antigua		British Guiana		Dutch Guiana		Grenada		St. Lucia		Saint Vincent		Trinidad	
	No.	P. C.	No.	P.C.	No.	P.C.	No.	P.C.	No.	P.C.	No.	P.C.	No.	P.C.	No.	P.C.
Examined	165866	....	18599	....	55612	....	17570	....	8236	....	18528	....	20313	....	27008	....
Infected	97632	58.9[1]	2919	15.7	32451	58.4	15945	90.8	5583	67.8	9832	53.1	11440	56.3	19462	72.1
Cured	73711	75.5[2]	2508	85.9	23769	73.2	13335	83.6	4156	74.4	6734	68.5	9513	83.2	13696	70.4
Removed	7391	7.6[2]	117	4.0	3537	10.9	1328	8.3	228	4.1	532	5.4	154	1.3	1495	7.7
Remaining in Area Uncured	16530	16.9[2]	294	10.1	5145	15.9	1282	8.0	1199	21.5	2566	26.1	1773	15.5	4271	21.9
Not Located	206	.2	29	1.0	44	.1	....	....	31	.6	....	....	7	....	95	.4
Refused	6159	6.3	54	1.8	1083	3.3	168	1.1	254	4.5	1879	19.1	330	2.9	2391	12.3
Medical Reasons	4561	4.7	203	7.0	1664	5.1	682	4.3	262	4.7	54	.5	510	4.5	1186	6.1
Under Treatment	5542	5.7	8	.3	2354	7.3	432	2.7	652	11.7	571	5.8	926	8.1	599	3.1
Not Classified	40	....	....	....	....	....	....	....	....	....	40	.4	....	....	....	....
Abandoned Treatment	22	....	....	....	....	....	....	....	....	....	22	.2	....	....	....	....

[1] Per cent of those examined.

[2] Per cent of those infected.

II

FORMS USED IN INTENSIVE WORK

The information collected in all measures for the relief and control of hookworm disease falls naturally under one of two heads: one relating to what is done; the other, to what is learned. The first object of the work, of course, is to relieve and control the disease; in the attempt to do this, however, much information of value in planning further work is incidentally gained.

It is necessary to have some systematic method of recording and reporting the results of the work in both of these phases. In addition, it is necessary for the medical director to have, for administrative purposes, certain forms for the use of his subordinates in collecting and presenting to him, daily and weekly, the results and progress of the work in the field. The most important forms used for these several purposes in our campaigns are presented, with explanatory notes, in the following pages:

The Census Book (Form 127)

The book for the use of nurses in taking the census provides space for recording the house number, name, age, sex, and race of individuals, and the kind of latrine accommodations found at their homes. The classification of latrines as shown on this form is very general, F indicating the absence of any latrine; E a latrine for privacy only, neither preventing soil pollution nor being screened against flies; and D any type of latrine effectually preventing soil pollution and so constructed that it is fly proof. A fourth section is provided for recording types of latrines which may be of

HOUSE NUMBER	NAME	AGE	SEX	RACE	CONTAINER DELIVERED (DATE)	SPECIMEN COLLECTED (DATE)	

Type of Latrine								Remarks
First Inspection				Last Inspection				
D	E	F	Other	D	E	F	Other	

Fig. 10. — Page of Census Book, Form 127
(Reduced facsimile; actual measurement of page, 16 x 5". For explanation of symbols "D", "E," "F", and "Other," see page 123.)

special significance in the country or district where the inspection is made.

Columns are provided for recording the dates when containers are delivered and when specimens are collected, and at the right there is a space for remarks.

The census books are usually of a size to accommodate 150 to 200 names. It is not desirable to have them larger, since they must be left at the central office for the purpose of recording the census in the case-record book, and it is better to have each book represent only one or two days' work.

THE CASE-RECORD BOOK (Form 100)

1. Purpose of the Book. The case-record book has been designed to provide for the medical record of each patient, as well as to give a complete census of the area and a record of the latrine improvement at the homes. By combining into a single book the three records (1) of census, (2) of examination and treatment, and (3) of latrine improvement, much re-writing may be saved. The effort has been made to make the case-record book as compact as possible. There are twenty lines and a total on each page, and the books may contain 100, 200, 500, or more pages.

2. Suggestions for Reporting. A sample page of the case-record book follows. It will be seen that opportunity is afforded for accounting for every person in the area of operation. Opposite the name of each person it is possible to indicate whether or not he was examined, and if not examined, the reason; if infected, whether or not he was given first treatment, and if not given first treatment, the reason; and if given first treatment, whether or not he was cured, and if not cured, the reason. The number of treatments required to cure each person

may also be recorded. It is possible in this way to exhibit the thoroughness of the work by showing (1) how many of the persons found infected were cured, and (2) how many of the persons found infected remained in the area uncured at the close of the work. Improvement in sanitation will be indicated by comparing latrine conditions at each home on the first inspection and on the last. A few remarks concerning the use of each section of the blank are given below:

(1) *Patient's Number.* The first column, headed "Patient's Number," will be filled in when the names in the census book are transferred to the case record.

(2) *Name.* In the column headed "Name" will be entered a complete census of the area. As far as possible the names in this column will be entered by families, with the name of the family-head first. The surname will be followed by the given name.

(3) *Residence.* The column headed "Residence" is for recording the street address of patients living in towns, or facts which may be of aid in locating homes in rural districts.

(4) *House Number.* The column headed "House Number" will be used in countries where, for the sake of convenience, each house is given a number by the census-taker.

(5) *Sex.* In the column headed "Sex" the initials M or F may be used for denoting whether the person is male or female.

(6) *Age.* The section headed "Age" has five divisions. The exact age of each person will be entered in the column corresponding to the age group to which he belongs.

(7) *Race.* The column headed "Race" has five divisions corresponding to the five major racial divisions of

mankind. The term "Brown Race" denotes the brown race of Malaya. Persons of mixed blood will be entered according to the predominating element in their blood. A check mark in the proper column will denote the race of each person.

(8) *Examined.* In the section headed "Examined," space is provided for indicating the results of each examination from the first to the eighth. In making the first examination, specimens are usually examined incidentally for other parasites in addition to hookworm. Under "First Examination," therefore, space has been provided for recording the number of specimens either positive or negative to hookworm, together with the number of specimens positive to the other intestinal parasites most commonly found, including Ascaris, Trichocephalus, Strongyloides, Oxyuris, Tenia, and Ameba. In the columns headed "Second Examination," "Third Examination," "Fourth Examination," "Fifth Examination," "Sixth Examination," "Seventh Examination," and "Eighth Examination," space is provided for reporting upon hookworm only. The month and day on which each examination is made will be entered and a check mark used for indicating which parasites are found.

When the examination is made on which the patient is found negative to hookworm, the month and day will be entered, and a small "c" inserted in the column headed "Uncinaria" to indicate that a cure has been effected. The addition of these small "c"-s will agree with the addition of the column headed "Cured" found further to the right.

It will be noticed that space has been provided in the case-record book for recording the results of eight examinations and eight treatments only. In some cases more examinations and more treatments may be necessary.

These may be forwarded to a new page. A note in the "Remarks" column opposite the patient's name will call attention to the record of examination and treatment being continued elsewhere.

(9) *Not Examined.* In the section headed "Not Examined" are four divisions, "Not Located," "Refused," "Removed," and "Died," to be used, respectively, for recording persons who are not examined either because (1) they cannot be located, (2) refuse to be examined, (3) remove before examination, or (4) die. A check mark in the proper column will indicate the reason for any person not being examined.

(10) *Treated.* The section "Treated" has eight sub-headings: "First Treatment," "Second Treatment," "Third Treatment," "Fourth Treatment," "Fifth Treatment," "Sixth Treatment," "Seventh Treatment," and "Eighth Treatment." Under each sub-heading, space is provided for the month and day on which each treatment is administered, and for the number of grains of thymol given.

(11) *Not Given First Treatment.* The next section, "Not Given First Treatment," has five sub-headings: "Not Located," "Refused," "Medical Reasons," "Removed," and "Died." These five sub-headings indicate, respectively, five reasons for failure to administer first treatment, as follows: (1) the patient cannot be located after examination, (2) he refuses to accept treatment, (3) he cannot be treated for medical reasons, (4) he has removed before treatment can be given, or (5) he has died. A check mark in the proper column will indicate why any particular person has not been given first treatment.

(12) *Given First Treatment but not Cured.* The section headed "Given First Treatment but not Cured,"

with its six sub-headings, "Not Located," "Refused," "Medical Reasons," "Removed," "Died," and "Under Treatment," is for recording persons who are given first treatment but are not kept under treatment until cured. A check mark in the proper column will indicate why any person given first treatment has not been continued under treatment until cured.

(13) *Cured.* The column "Cured" will indicate, by the presence or absence of a check mark, whether or not the person has been cured. No person will be entered as cured until he has been found negative on careful microscopic re-examination following treatment.

(14) *Latrine Improvement.* The heading "Latrine Improvement" is divided into twelve columns, six under the sub-heading "First Inspection," and six under the sub-heading "Last Inspection." Of these six columns, four are for recording the types of latrines found, and the fifth and sixth for the date of the inspection. The headings of the four columns for recording the types of latrines are, respectively, D, E, F, and "Other." The significance of these headings is as follows: D indicates any type of latrine which prevents soil pollution and is fly-proof. This includes (1) the fly-proof pail latrine, where the ultimate disposal of the night soil is under careful supervision, and is satisfactory; (2) the pit latrine, when fly-proof and so located that the drinking-water supply is not endangered by pollution; (3) septic tanks satisfactorily constructed; (4) sewerage; and (5) incineration plants. The E denotes any types of latrines which do not prevent soil pollution or which permit flies to have access to the excreta. This includes (1) all latrines built for privacy only; (2) pail latrines, where disposal is unsatisfactory and the latrines are not fly-proof; (3) pit latrines not fly-proof and located so as

to endanger the drinking-water supply; and (4) septic tanks improperly constructed or not kept in order. F indicates no latrine of any kind. The column headed "Other" is for recording any special types which may be of particular significance in the country or district where the inspection is made.

Two inspections are provided for: first and last. The first inspection is made when the census of an area is taken. The last may be made at the close of the campaign or later, as determined by the medical director. A comparison of the results of the two inspections will indicate the latrine improvement resulting directly or indirectly from the campaign.

In recording the results of a latrine survey under these heads, one latrine is recorded for each household. Where one large latrine serves several households, the type of this latrine is recorded as many times as there are households using the latrine.

MICROSCOPIC REPORT SHEET (Form 130)

This sheet is for the use of the chief microscopist in recording the daily work of his department. By using the initial letter of each microscopist or a distinguishing number to indicate positive findings, the comparative efficiency of each microscopist is made evident.

The headings of the first three columns on this form may need some explanation. In Column 1, "House Number" indicates the number of the home in which the individual lives. In Column 2, "Patient's Number" is the number given the patient in the case-record book. In Column 3, "Examination Number" indicates whether the examination is the first, second, third, etc.

FORM 130

MICROSCOPIC REPORT

NURSE'S NAME DISTRICT No. SHEET No.

DATE RECEIVED DATE EXAMINED DATE RECORDED

	HOUSE NUMBER	PATIENT'S NUMBER	EXAMINATION NUMBER	NAME	HOOKWORM	ASCARIS LUMBRI-COIDES	TRICHO-CEPHALUS DISPAR	STRONGY-LOIDES STERCORALIS	OTHER PARASITES	CENTRIFUGE NUMBER
1										
2										
3										
4										
5										
6										
7										
8										
9										

13											
14											
15											
16											
17											
18											
19											
20											
				TOTAL							

SUMMARY OF FINDINGS

MICROSCOPIST NAME	SYMBOL	POSITIVE FINDINGS
TOTAL		

RESULTS OF EXAMINATIONS

EXAMINATION	1	2	3	4	5	6	7	8
POSITIVE								
NEGATIVE								
TOTAL								

SIGNED ______________________ CHIEF MICROSCOPIST

Fig. 12. — Microscopic Report, Form 130
(Reduced facsimile; actual measurement, 8½ x 11″.)

Treatment Book (Form 128)

This book is for the use of the nurses in giving treatment in the field. In it are recorded the name of the area, the number of the nurse's district, the name of the nurse, and the house number, patient's number, name, age, and sex of every infected person in the nurse's district. Following each name, columns are provided for recording the dose of the anthelmintic, the date, and the result of re-examination following each treatment. It will be noted that the column for re-examinations first appears after second treatment, and then successively after each treatment. It has not been found necessary to examine the patients after the first treatment, since so few are cured by one treatment. Columns are provided for eight treatments and seven re-examinations.

These books should be of a size to accommodate 200 names, which is probably the maximum number of infected people that will be included in a nurse's district.

Nurses' Reports: Daily, Weekly, and Summary (Forms 131, 132, and 129)

The three following forms for nurses' reports are for administrative purposes only:

1. Nurses' Daily Report Sheet. In order to keep the medical director informed of the progress of the work and of the efficiency of the nurses, each nurse is required to make a daily report of the work accomplished in his district. Form 131 is for this purpose and provides for reporting the total number of patients under treatment, the number of first to eighth treatments given, and the number of specimens collected. The nurse's name, the district, and the date also form a part of each daily report.

2. Nurses' Weekly Report Sheet. This report is more elaborate than the daily report, as it shows the progress in each nurse's district by weeks, from the beginning to the close of the work. At the end of each week entries are made on this sheet showing the name of the nurse and the number of people found positive. Under the heading "Before Treatment" there are recorded the "Number not treated for medical reasons," "Number removed," "Number refusing treatment," "Number not located," and "Number died"; in eliminating these from the "Number positive," we have the "Total number available for treatment." Of those "Available for treatment," those "Given first treatment" appear in the proper column and also the "Total number of treatments" given. Under the heading "After Treatment" are columns for the "Number cured," the number "Discontinued treatment for medical reasons," "Number removed," "Number refused," and "Number died." Three additional columns provide space for recording the "Number remaining after first treatment," the "Number under treatment," and the "Number now available for treatment." A consideration of all of these facts at the end of each week shows the director, not only the progress of the work, but its extent in the beginning in that particular district and its progress toward completion.

3. Nurses' Weekly Summary Report Sheet. Upon this sheet is summarized all information contained in the nurses' weekly reports. At a glance the Director can see the status of work in any nurse's district and judge of the efficiency of that nurse, and he can also sum up the situation for the entire area of operation.

HOUSE NUMBER	PATIENT'S NUMBER	DAY OF TREATMENT	NAME	AGE	SEX	1ST TREATMENT		2D TREATMENT		RE-EXAMINATION	
						DATE	DRUG & DOSE	DATE	DRUG & DOSE		

	3D TREATMENT		RE-EXAMINATION	4TH TREATMENT		RE-EXAMINATION	5TH TREATMENT		RE-EXAMINATION	6TH TREATMENT		RE-EXAMINATION	7TH TREATMENT		RE-EXAMINATION	8TH TREATMENT		RE-EXAMINATION
	DATE	DRUG & DOSE		DATE	DRUG & DOSE		DATE	DRUG & DOSE		DATE	DRUG & DOSE		DATE	DRUG & DOSE		DATE	DRUG & DOSE	

Fig. 13. — Page of Treatment Book, Form 128
(Reduced facsimile; actual measurement, 16 x 5".)

FORM 131

NURSES DAILY REPORT

NURSE'S NAME DATE SHEET No.

DISTRICT NUMBER NUMBER OF PATIENTS UNDER TREATMENT

	PATIENT'S NUMBER	TREATMENTS								TINS COL-LECTED	REMARKS
		1ST	2D	3D	4TH	5TH	6TH	7TH	8TH		

Fig. 14. — Nurses' Daily Report, Form 13
(Reduced facsimile; actual measurement, 8½ x 11".)

FORM 132

NURSES WEEKLY REPORT

DISTRICT NUMBER TREATMENT BEGUN (DATE)

	WEEK ENDING		NURSE	NUMBER POSITIVE	BEFORE TREATMENT					TOTAL NUMBER AVAILABLE FOR TREATMENT	NUMBER GIVEN FIRST TREATMENT	TOTAL NUMBER OF TREATMENTS	AFTER TREATMENT					NUMBER REMAINING FOR FIRST TREATMENT	NUMBER UNDER TREATMENT	NUMBER NOW AVAILABLE FOR TREATMENT
					NUMBER NOT TREATED FOR MEDICAL REASONS	NUMBER REMOVED	NUMBER REFUSED	NUMBER NOT LOCATED	NUMBER DIED				NUMBER CURED	DISCONTINUED TREATMENT FOR MEDICAL REASONS	NUMBER REMOVED	NUMBER REFUSED	NUMBER DIED			
		TOTAL FOR WEEK																		
		TOTAL TO DATE																		
		TOTAL FOR WEEK																		
		TOTAL TO DATE																		
		TOTAL FOR WEEK																		
		TOTAL TO DATE																		
		TOTAL FOR WEEK																		
		TOTAL TO DATE																		
		TOTAL FOR WEEK																		
		TOTAL TO DATE																		

FOR WEEK	TOTAL TO DATE	TOTAL FOR WEEK	TOTAL TO DATE	TOTAL FOR WEEK	TOTAL TO DATE	TOTAL FOR WEEK	TOTAL TO DATE	TOTAL FOR WEEK	TOTAL TO DATE	TOTAL FOR WEEK	TOTAL TO DATE	TOTAL FOR WEEK	TOTAL TO DATE

Fig. 15. — Nurses' Weekly Report, Form 132
(Reduced facsimile; actual measurement, 8½ x 11".)

FORM 129

NURSES WEEKLY SUMMARY

REPORT FOR WEEK ENDING

DISTRICT NUMBER	NURSE	CENSUS	NOT EXAMINED	POSITIVE	POSITIVE BUT NOT TREATED	REMAINING UNDER TREATMENT			CURED

Fig. 16. — Nurses' Weekly Summary, Form 129
(Reduced facsimile; actual measurement, 8½ x 11".)

The Diary (Form 48)

The diary (Form 48) is intended to record information on educational work. It is designed to be small enough to be carried conveniently by the medical director. Each page provides space for recording the educational work of three days. At the top of the section for each day will be written the date, and the town, village, or locality visited by the medical director. The number of lectures delivered, the attendance at each, and the number of pieces of literature distributed, by classes, will then be inserted in the spaces provided. A sample page of the diary appears on page 145.

Educational work may be roughly divided into two main classes: first, that by lectures; and second, that by literature. Lectures are of three kinds: public, to an audience of twenty or more persons not selected in any way; school, to an audience composed of school children; and special, to any group of persons belonging to a special class, such, for instance, as teachers, physicians, or mothers. Literature falls into four general classes: first, letters; second, pamphlets; third, leaflets; and fourth, notices or bulletins. The first includes all personal or circular letters written to any person in behalf of the work; the second, printed books or booklets more than four book pages in length; the third, the same class of printed matter as the second but less than four pages in length; while the fourth class includes notices or bulletins (placards) printed on a single sheet, giving notices of public meetings and other features connected with the work. Educational work in all of its phases is of course much more extensive than this, but it is believed that space has been provided for all of the features connected with this work which it is possible definitely to report.

FORM 48

DATE PLACE

LECTURES DELIVERED			LITERATURE DISTRIBUTED	
KIND	NUMBER	ATTENDANCE	KIND	NUMBER
PUBLIC			LETTERS	
SCHOOL			PAMPHLETS	
SPECIAL			LEAFLETS	
			NOTICES & BULLETINS	
TOTAL			TOTAL	

REMARKS

FORM 48

DATE PLACE

LECTURES DELIVERED			LITERATURE DISTRIBUTED	
KIND	NUMBER	ATTENDANCE	KIND	NUMBER
PUBLIC			LETTERS	
SCHOOL			PAMPHLETS	
SPECIAL			LEAFLETS	
			NOTICES & BULLETINS	
TOTAL			TOTAL	

FORM 48

DATE PLACE

LECTURES DELIVERED			LITERATURE DISTRIBUTED	
KIND	NUMBER	ATTENDANCE	KIND	NUMBER
PUBLIC			LETTERS	
SCHOOL			PAMPHLETS	
SPECIAL			LEAFLETS	
			NOTICES & BULLETINS	
TOTAL			TOTAL	

REMARKS

Fig. 17. — Page of Diary, Form 48

(Reduced facsimile; actual measurement 4 x 6¼".)

The records of educational work as kept in the diary are transferred at the close of the work in each area to the section headed "Educational Work" on Form 133.

Geographical Area Report on Completed Work (Form 133)

The geographical area report on completed work provides space for all of the details usually reported upon in work by the intensive method. In it a complete summary of the work in any geographical area may be given. It is not prepared until the work in the area has ended. These reports are furnished in duplicate, one for the government of the country where the work is in progress, and the other for the International Health Board. It is important that they cover the entire field of activities of the force, and at the same time be simple but intelligible, requiring the minimum of the director's time and attention in their preparation.

All of the information requested on this form is obtained from the case-record book (Form 100) except that for "Educational Work." Information on educational work is recorded in the diary (Form 48) and is obtained from it. It is believed that sufficient explanation of the headings on the geographical area report has already been given in the pages describing the case-record book and the diary.

Quarterly Report on Completed Work (Form 50)

This report is prepared and forwarded by the medical director at the end of each quarter. It is intended to show at a glance the results accomplished in geographical areas in which work has been completed during the quarter. The information it contains is taken entirely from the geographical area report. Two copies of the report are prepared, as in the case of Form 133, and one forwarded with the latter form to the government, the other to the International Health Board.

Quarterly Report on Work in Progress (Form 51)

This report is also prepared and forwarded by the medical director at the end of each quarter. It is intended to show at a glance the results accomplished in geographical areas in which the work has been in progress but has not been completed at the end of the quarter. It is identical with Form 50 in all respects except the heading. For Form 51 no supporting geographical area reports are desired. Two copies of the report are prepared as with Forms 133 and 50, one being forwarded to the government and the other to the International Health Board.

Special Monthly Report for the Information of Regional Directors

The regional directors of territories in which intensive work is being conducted may wish to keep more intimately in touch with the progress of the work than can be done by means of the regular quarterly reports above described. This may be accomplished by having the medical director in charge of the work in each country mail monthly to the regional director a special report on a form similar to that shown on page 154. This will give information concerning the total results accomplished by the staff during the month, irrespective of the areas in which it was engaged, while, by showing the number of employes of each class, it will enable the regional director to measure progress and to apply pressure if satisfactory results are not being obtained in every department.

Narrative Report

Each quarterly statistical report is usually accompanied by a narrative report prepared by the medical director.

FORM 133

GEOGRAPHICAL-AREA REPORT ON COMPLETED WORK FOR THE RELIEF AND CONTROL OF HOOKWORM DISEASE

OF

DATE WORK BEGAN DATE WORK ENDED

AREA SQ. MILES. BUDGET NO.

EXAMINATION, TREATMENT, AND CURE

CENSUS	GIVEN FIRST EXAMINATION	NOT GIVEN FIRST EXAMINATION						POSITIVE TO HOOKWORM ON FIRST EXAMINATION	NEGATIVE TO HOOKWORM ON FIRST EXAMINATION
		TOTAL	NOT LOCATED	REFUSED	REMOVED	DIED	NOT CLASSIFIED		

GIVEN FIRST TREATMENT	CURED	NOT GIVEN FIRST TREATMENT							GIVEN FIRST TREATMENT BUT NOT CURED							
		TOTAL	NOT LOCATED	REFUSED	MEDICAL REASONS	REMOVED	DIED	NOT CLASSIFIED	TOTAL	NOT LOCATED	REFUSED	MEDICAL REASONS	REMOVED	DIED	UNDER TREATMENT	NOT CLASSIFIED

OTHER PARASITES

GIVEN FIRST EXAMINATION	POSITIVE TO ANY PARASITE	PARASITES FOUND ON FIRST EXAMINATION							
		HOOKWORM	ASCARIS	TRICHOCEPHALUS	STRONGYLOIDES	OXYURIS	TAENIA	AMOEBA	

RE-EXAMINATIONS

ALL RE-EXAMINATIONS			RE-EXAMINATIONS AFTER FIRST TREATMENT			RE-EXAMINATIONS AFTER SECOND TREATMENT			RE-EXAMINATIONS AFTER THIRD TREATMENT		
TOTAL	POSITIVE	NEGATIVE	TOTAL	POSITIVE	NEGATIVE	TOTAL	POSITIVE	NEGATIVE	TOTAL	POSITIVE	NEGATIVE

RE-EXAMINATIONS AFTER FOURTH TREATMENT			RE-EXAMINATIONS AFTER FIFTH TREATMENT			RE-EXAMINATIONS AFTER SIXTH TREATMENT			RE EXAMINATIONS AFTER SEVENTH AND SUBSECENT TREATMENTS		
TOTAL	POSITIVE	NEGATIVE	TOTAL	POSITIVE	NEGATIVE	TOTAL	POSITIVE	NEGATIVE	TOTAL	POSITIVE	NEGATIVE

TREATMENTS

TOTAL TREATMENTS	FIRST TREATMENT	SECOND TREATMENT	THIRD TREATMENT	FOURTH TREATMENT	FIFTH TREATMENT	SIXTH TREATMENT	SEVENTH TREATMENT	EIGHTH TREATMENT	NINTH AND SUBSEQUENT TREATMENTS

INFECTION BY RACES

ALL RACES		WHITE RACE		BLACK RACE		BROWN RACE		YELLOW RACE		RED RACE		NOT CLASSIFIED BY RACE	
GIVEN FIRST EXAMINATION	POSITIVE ON FIRST EXAMINATION	GIVEN FIRST EXAMINATION	POSITIVE ON FIRST EXAMINATION	GIVEN FIRST EXAMINATION	POSITIVE ON FIRST EXAMINATION	GIVEN FIRST EXAMINATION	POSITIVE ON FIRST EXAMINATION	GIVEN FIRST EXAMINATION	POSITIVE ON FIRST EXAMINATION	GIVEN FIRST EXAMINATION	POSITIVE ON FIRST EXAMINATION	GIVEN FIRST EXAMINATION	POSITIVE ON FIRST EXAMINATION

SANITARY IMPROVEMENT

				LAST INSPECTION					
TOTAL HOMES	HOMES WITH PRIVIES		HOMES WITHOUT PRIVIES	TOTAL HOMES	HOMES WITH PRIVIES		HOMES WITHOUT PRIVIES	EXTRA PRIVIES AT HOMES	
	"D"	E			"D"	E		"D"	"E"

NEW PRIVIES ERECTED AT HOMES			NEW PRIVIES ERECTED AT PLACES NOT HOMES			OLD PRIVIES IMPROVED AT HOMES	OLD PRIVIES IMPROVED AT PLACES NOT HOMES		
TOTAL	"D"	"E"	TOTAL	"D"	"E"				

EDUCATIONAL WORK

LECTURES						LITERATURE			
NUMBER			ATTENDANCE			LETTERS	PAMPHLETS	LEAFLETS	NOTICES AND BULLETINS
PUBLIC	SCHOOL	SPECIAL	PUBLIC	SCHOOL	SPECIAL				

EXPENDITURES

SOURCE OF FUNDS					
INTERNATIONAL HEALTH BOARD	GOVERNMENT	STATE OR PROVINCE	COUNTY	COMMUNITY OR DISTRICT	OTHER SOURCES

PER CAPITA COST

BASED ON TOTAL FUNDS			BASED ON INTERNATIONAL HEALTH BOARD'S FUNDS ONLY		
PER PERSON EXAMINED	PER PERSON TREATED	PER PERSON CURED	PER PERSON EXAMINED	PER PERSON TREATED	PER PERSON CURED

PERSONNEL

NAME OF DRUG USED

I HEREBY CERTIFY THAT THIS REPORT IS AN ACCURATE SUMMARY OF THE CASE RECORD

(SIGNED)

Fig. 18. — Geographical Area Report on Completed Work, Form 133
(Reduced facsimile; actual measurement, 8½ x 11". For explanation of symbols "D", "E", "F", and "Other," see page 130.)

FORM 50

QUARTERLY REPORT ON WORK FOR THE RELIEF AND CONTROL OF UNCINARIASIS

IN FOR THE QUARTER ENDING

GEOGRAPHICAL AREAS IN WHICH WORK HAS BEEN COMPLETED DURING THE QUARTER

GEOGRAPHICAL AREA	CENSUS	GIVEN FIRST EXAMINATION	REFUSED EXAMINATION	REMOVED BEFORE EXAMINATION	INFECTED ON FIRST EXAMINATION	GIVEN FIRST TREATMENT	CURED	TREATMENT REFUSED	REMOVED BEFORE CURED

GEOGRAPHICAL AREA	NUMBER OF HOMES	HOMES WITH PRIVIES WHEN WORK BEGAN	NEW PRIVIES ERECTED	OLD PRIVIES IMPROVED	LECTURES DELIVERED	HEMOGLOBIN TESTS	DATE WORK BEGAN	DIRECTOR
TOTAL								

Fig. 19. — Quarterly Report on Completed Work, Form 50
(Reduced facsimile; actual measurement, $8\frac{1}{2} \times 11''$)

MONTHLY REPORT FOR THE INFORMATION OF THE

REGIONAL DIRECTOR FOR THE ________
territory

Report of the hookworm campaign in ____________ for the month of ________
name of country

(1) Additions to census ________

(2) Refused examination ________

(3) Removed before examination ________

(4) First examinations made ________

(5) Re-examinations ________

(6) Total microscopic examinations ________

(7) First treatments given ________

(8) Treatments refused ________

(9) Removed before cured ________

(10) Total treatments ________

(11) Cured ________

(12) Expenditures for month:

Medical director, salary and traveling expenses $________

Rest of staff $________

(13) Number of micropists employed ________

(14) Number of nurses employed ________

(15) Remarks ____________________

____

____

(Signed) ____________________
Medical Director

Fig. 21. — Special Monthly Report For Information of Regional Directors

(Reduced facsimile; actual measurement, 8½ x 11″)

When a new area of operation is entered, this narrative report deals with the population, its nature and distribution, living conditions, topography of the area, and a general description of the conditions to be met.

Narrative reports on areas where work is in progress may be brief, setting forth interesting features which have developed and the progress made in the area.

The narrative report of a completed area is expected to combine all information given in previous narrative reports regarding this area, and to give a final summing up of results and the local conditions which have favored or hindered the work. In addition, this report may mention the general conditions responsible, in the beginning, for the presence and spread of hookworm disease, and the measures taken to remedy these conditions.

The annual narrative report obviously should deal with the work and experiences of the entire year and is more or less a combination of all narrative reports for the year.

BUDGET (Form 12)

Each budget is a detailed statement of the funds required for work in a country or a state, or by a definite unit of working force during a fixed period of time. A typical annual budget for a standard unit of working force where work is done by the intensive plan is shown on pages 156–157. Where there are several units of force operating in a state or country, each has its own budget. Each budget bears in its upper right-hand corner a serial number by which it is known, and each item for which the expenditure is fixed is given an independent item-number. After being duly approved and signed by the proper authority, the total expenditure authorized by a budget, or the amount set apart for any of its numbered items, cannot be changed, or the funds under one item

THE ROCKEFELLER FOUNDATION
61 BROADWAY, NEW YORK, U. S. A.

BUDGET NO. 6164
DATE October 31, 1916

FOR (Name of country or colony)

AUTHORIZED BY meeting of International Health Board, October 31, 1916

PERIOD COVERED BY BUDGET January 1 to December 31, 1917

ITEM NUMBER	DESCRIPTION			TOTAL ALLOTMENT
	FIELD OFFICE FUNDS			
	Salaries			
1	Medical Director			
2	Clerical Force			
	Chief Clerk	$500.00		
	Clerical Assistant . . .	420.00	$ 920.00	
3	Microscopists			
	Chief Microscopist . . .	480.00		
	3 Assistants	1,200.00	1,680.00	

		[illegible] . . [illegible],[illegible]00.00	4,680.00	
	5	Caretaker	120.00	
	6	Office Expenses and Equipment		
		Furniture, Rent, Light, Water, etc. . .	555.00	
		Printing Record Books, Forms, Literature, etc.	250.00	
	7	Contingent Fund	300.00	$ 8,505.00
		HOME OFFICE FUNDS		
	18	Scientific Equipment, Containers, Supplies, etc.	972.50	
	19	Drugs	3,000.00	
	20	Contingent Fund	200.00	4,172.50
				$12,677.50
FORM 12		SIGNED		
		SEE OTHER SIDE FOR DISTRIBUTION		

Fig. 22. — Budget, Form 12
(Reduced facsimile; actual measurement, 8½ x 11".)

be applied to expenses under another, except by the authorization and issuance of a new budget embodying the necessary modifications and bearing another serial number. As a separate account is kept of the expenditures under each numbered item, in arranging superseding budgets it is essential not to disturb the previously assigned item-numbers, as this would lead to confusion of accounts.

In the experience of the International Health Board in the foreign field it has been found that items such as drugs, scientific instruments, etc., in certain cases may be purchased more advantageously in the United States than either locally or in European markets. In such cases funds to pay for these items are held in the Home Office to avoid double charges for exchange, and such amounts are designated "Home Office Funds." All budgetary funds which are to be expended in the country where work is in progress, such as salaries, rent, office furniture, etc., are known as "Field Office Funds."

Budgets are usually arranged to provide funds for a definite working force operating during a calendar year. In certain cases they are made for a shorter time, but they never overlap from one calendar year to another. At the end of a calendar year all unexpended budgetary funds automatically revert to the source of such funds, which in our work in the West Indies is the International Health Board, only becoming available for expenditure by official action appropriating them to the needs of a new budget.

Explanatory Notes on Budget

1. Salaries. The salary and traveling allowance of the medical director (*item* 1) are not included in the budget, as these are subject to wide variations accord-

ing to the country where such work is undertaken and the grade of service from which the medical director is secured. No traveling allowance is made to any member of the force except the medical director.

The maximum salary of chief clerks in the West Indies (*item* 2) is placed at $50.00 per month. As a rule they may be employed for less. The assistant clerk is never paid more than $35.00 per month.

The maximum salary of the chief microscopists (*item* 3) has been fixed at $40.00 per month; the assistant microscopists receive from $25.00 to $35.00 per month.

The maximum salary of the chief nurse (*item* 4) is $40.00 per month. The nurses are paid from $25.00 to $35.00 per month. The annual estimate of $4,200, or $350.00 per month, for the item of assistant nurses in the sample budget, is based on the following arrangement of salaries:

	Per month	Per year
6 Nurses at $25.00 per month	$150.00	$1800.00
3 " " 30.00 " "	90.00	1080.00
3 " " 35.00 " "	105.00	1260.00

The additional $5.00 per month is for bonuses for the nurses showing the highest efficiency in their work.

The caretaker (*item* 5) is usually a woman who lives near the laboratory office and who may be employed for a comparatively small salary.

2. Office Equipment. The equipment (*item* 6) consists of the following items:

(1) Office and laboratory furniture, including tables, one typewriter, chairs, lockers, file cases, bowls, buckets, towels, etc.
(2) Stationery, envelopes, etc.
(3) Rents, light, and water supply in office and laboratory.
(4) Printing of record books, forms, literature, etc.

3. Scientific Equipment. This equipment for one unit of force (*item* 18) consists of the following items:

1 Microscope, portable, equipped with triple revolving nose-piece; objectives 16, 4, and 1.9 m.m.; Abbe condenser, screw sub-stage. (Cat. No. APS–8.)
3 Microscopes, portable, equipped with double revolving nose-piece; objectives 16 and 4 m.m.; two eye-pieces, 5 and 10X. (Cat. No. APS–4.)
4 Mechanical stages to fit above microscopes and adapted to use of 2 x 3″ slides.
2,000 Microscope slides, 2 x 3″.
2 Special double-speed hand centrifuges with Stewart panheads.
600 Special tubes for Stewart panheads.
112,500 Corks for centrifuge tubes.
300 Funnels to fit centrifuge tubes.
1,600 Flat-bottom vials.
250,000 Flat wooden toothpicks.
6 Talquist hemoglobin index books.
1 Balopticon, with accessories consisting of 2 Prest-O-Lite gas tanks, 1 screen, 1 standard set lantern slides, 2 hookworm charts.
1 Camera, with accessories, as follows:
1 Leather carrying-case, 1 tripod, 2 dozen 6-exposure film rolls in tin.
450 Gross containers.[1]

4. Drugs. The amount allowed for drugs (*item* 19) is based upon the supposition that one unit of force will handle a population of 15,000 people annually, where there is an average rate of infection of 65 per cent. This would mean that in a year the one unit of force would need to treat approximately 9,750 infected people. The average amount of thymol necessary to cure an adult case is 120 grains. This would be administered in capsules which contain 10 grains of finely powdered thymol combined with approximately an equal quantity of milk

[1] Experience shows that with an average infection of 65 per cent, 30 gross of tin specimen containers are required for each one thousand of population. For a population of 15,000, 450 gross would be required which at the present price of 75 cents per gross would cost approximately $337.50.

sugar. Twelve of these capsules would be required as an average to each case. About one-fifth of the cases found infected are usually children who require only one-half the adult dose of thymol, or 60 grains. For use with children, the thymol is put up in gelatin capsules also, each containing 5 grains of powdered thymol and an equal quantity of milk sugar.[1] An average of twelve capsules is required for each case treated. The prices for these capsules are very high at present and are subject to change owing to the decrease in the production of thymol because of the war, thymol having advanced 300 per cent in the last two years.

The following table shows in detail the annual estimate for thymol for one unit of force:

To be treated		*Thymol capsules required*		*Cost*
Children	1,950	23,400	5 grain	$300.83
Adults	7,800	93,600	10 grain	$2,481.52
Total	9,750	117,000		$2,782.35

Sulphate of magnesia has seemed to serve best as the agent to be used in clearing out the alimentary canal, both before and after the administration of thymol. It is estimated that each adult case treated will require two-thirds of a pound of magnesium sulphate, and each child one-half pound. At present this salt in bulk, packed in kegs of 125 pounds each for ocean transportation, is costing approximately 4½ cents per pound. The following table shows in detail the annual estimate for magnesium sulphate for one unit of force:

To be treated		*Magnesium sulphate required*		*Cost*
Children	1,950	975	pounds	$43.88
Adults	7,800	5,200	"	$234.00
Total	9,750	6,175	"	$277.88

[1] The powder is taken out of the capsule and administered with water or in syrup in cases of children too small to swallow the capsule.

THE ROCKEFELLER FOUNDATION
61 BROADWAY, NEW YORK

FINANCIAL REPORT
DATE

FOR

BUDGET No.

PERIOD COVERED BY REPORT

BUDGET ITEM NUMBER	DESCRIPTION	RECEIPTS	EXPENDITURES	BUDGET ALLOTMENT FOR PERIOD
	BALANCE FORWARD			
	RECEIPTS DURING PERIOD:			
	EXPENDITURES DURING PERIOD:			

TOTAL

BALANCE

TOTAL

REPORT CERTIFIED CORRECT

SIGNED ....

SIGNED ....

FORM 24

Fig. 23. — Financial Report, Form 24
(Reduced facsimile; actual measurement, 8½ x 11")

The estimated cost of thymol capsules and magnesium sulphate thus amounts to approximately $3,000 annually for each unit of force.

5. Contingent Fund. The contingent fund (*items 7 and* 20) is intended to meet emergency expenses not otherwise provided for in the budget, such as freight, cartage, postage, etc. A part of the contingent fund is usually allotted to "Field Office Funds" and the remainder to "Home Office Funds."

Note should be made of the fact that a large part of the expenditure under 6 and 18, is for permanent office and scientific equipment. A force once fully equipped will require subsequently but a very small outlay for minor supplies under these heads.

Quarterly and Yearly Financial Reports (Form 24)

The financial report form shown on pages 162 and 163 has been prepared for use by Medical Directors in the field in reporting receipts and expenditures. This form is so worded as to be adapted to a report covering a year or any other period.

In making out the financial reports care should be taken to observe the following:

(1) After "For" at the top of the form put the name of the country, area, or other description. Copy the exact words used in this place on the Budget.

(2) Under "Receipts during Period" describe accurately the checks, drafts, letters of credit, and other forms of remittance.

III

LIST OF STANDARDIZED SUPPLIES AND PRICES

Since the outbreak of the Great War it has become very difficult for medical directors to buy and secure prompt delivery of supplies of any nature directly from the manufacturers. This has led the International Health Board to offer its services to the medical directors in various countries to place orders for supplies and expedite the shipment of these as much as possible. No charge is made for this service.

The following is a list of supplies for which the International Health Board is prepared to place orders. The prices given are approximate only and subject to change:

APS-8 Portable Microscope, equipped with triple revolving nose-piece; objectives 16, 4 and 1.9 m.m.; two eye-pieces 5 and 10X; Abbe condenser in quick acting screw sub-stage.
Price $72.50 each.

APS-4 Portable Microscope, equipped with double revolving nose-piece; objectives 16 and 4 m.m.; and two eye-pieces 5 and 10X.
Price, $40.50 each.

No. 2116 Mechanical Stages for above microscopes.
Price, $16.00 each.

2 x 3" Microscope Slides (500 per microscope).
Price, $2.25 per 100.

Talquist Hemoglobin Scale Books.
Price, $1.75 each.

No. 19002 Double-speed hand Centrifuge without sedimentation attachment, hematokrit, or accessories of any kind, with separate clamp.
Price, $5.50 each.

Stewart panheads for double-speed hand Centrifuges, equipped with nut for fastening on centrifuge, and without milk tubes, rubber corks, and nipples regularly supplied.
Price, $9.00 each.

Special Tubes for Stewart panhead, heavy wall.
Price, $1.50 per 100.

Corks for Tubes, No. O, XXXX quality.
Price, $.20 per 100.

Glass Funnels, 40 m.m., to fit special tubes.
Price, $18.00 per 100.
Vials, flat-bottom, 25 m.m. high, 15 m.m. diameter.
Price, $1.00 per 100.
Prest-O-Lite Gas Tanks, 10 cubic feet.
Price, $10.00 each.
Model "C" Balopticon, with acetylene burner.
Price, $52.20 each.
Tin Containers (¼ ounce).
Price, $0.75 per gross.
Cases of Toothpicks, each containing 180,000.
Price, $2.50 per case.
Standard Set of Lantern Slides, containing 47 slides numbered 1 to 55 inclusive, excepting Nos. 31, 43, 44, 46, 47, 48, 49 and 54.
Price, $.27½ each.
Lantern Slide Carrying Case, Style "C," detachable cover, Cat. No. 3660, for 80 slides.
Price, $2.25 each.
3-A Autographic Kodak, with Kodak Anastigmat Lens, f. 7.7, and Automatic shutter.
Price, $32.50.
Black Sole Leather Case with strap.
Price, $2.00 each.
Films for Camera, 6-exposures, in sealed tins.
Price, $.40 per roll.
Hookworm chart, International Health Board.
Price, $5.00 each.
Thymol, in bulk, crystalline, in 25-pound tins.
Price, $16.00 per pound.
Cost of capsulating Thymol:

Thymol, 10 grains; sugar of milk, 8 grains,	$3.20 per 1,000
Thymol, 5 grains; sugar of milk, 5 grains,	$1.20 " "
Thymol, 2½ grains; sugar of milk, 2½ grains,	$.90 " "

Allowing 2% for waste,

1,000	2½ grain capsules require			.3642 pounds Thymol,	
1,000	5 "	"	"	.7285 "	"
1,000	10 "	"	"	1.457 "	"

(The pounds used here are avoirdupois)
Magnesium Sulphate, in kegs of 125 pounds each.
Price, $.04½ per pound.
Oil of Chenopodium, in bulk, packed in 1-gallon jacketed tins.
Price, $60.00 per gallon.
Oil of Chenopodium, 10 minim flexible capsules (not recommended).
Price, $26.10 per 1,000.
Oil of Chenopodium, 5 minim flexible capsules (not recommended).
Price, $14.60 per 1,000.

Capsules required for 1 gal. Chenopodium

1 Gal. = 61440 minims U.S. Apoth. Fluid Measure

Quantity Chenopodium	*Size capsules*	*Contents capsules*	*No. capsules*
1 Gal. chenopodium requires	000	16 minims each	3840
" " " "	00	14 minims "	4389
" " " "	0	9 minims "	6827
" " " "	1	7 minims "	8778
" " " "	2	5 minims "	12288
" " " "	3	4 minims "	15358
" " " "	4	3 minims "	20480
" " " "	5	2 minims "	30720

No allowance is made here for imperfect capsules. These often amount to as much as 10%.

IV

DOSAGE TABLE

Dosage of Thymol and Solution Magnesium Sulphate

Apparent Age of Patient[1]	*Dose of Thymol*	*Dose of Magnesium Sulphate Solution*
1 to 5 years	3 to 5 grains	2 drachms
6 to 10 "	10 to 15 "	4 "
11 to 15 "	15 to 30 "	6 "
16 to 20 "	30 to 45 "	8 "
21 to 50 "	45 to 60 "	12 "
Over 50 "	30 to 45 "	12 "

The magnesium sulphate solution is prepared by dissolving 15 pounds of the salts in 3 gallons of boiling water. This gives approximately a 2 to 1 solution, i.e., 2 drachms contain in solution 1 drachm of magnesium sulphate.

[1] In arranging dosage by "Apparent age of patient," it is intended that the age in years should not be the only factor, but that due consideration should be given to the robustness, development, and size of the patient.

V

GENERAL INSTRUCTIONS FOR NURSES

The nurse must discontinue treating persons who develop the following conditions during the course of treatment, and must not resume their treatment until directed to do so by the medical director:

(1) Very old and feeble persons who are markedly depressed by the treatment.

(2) Children under five years of age who are made ill by the treatment.

(3) Persons who develop acute malaria, dysentery, diarrhea, rheumatism, or fevers.

(4) Pregnant women. These should never be treated outside of hospital.

(5) Persons who develop dropsical swelling of face or lower limbs.

Before treating a person showing signs of ill health, the nurse should make inquiries to ascertain if any of the following conditions exist:

(1) Swelling or dropsy of the feet and ankles, or face; or bloody urine and suppression of urine. These are often indications of kidney affections which contraindicate the administration of both thymol and chenopodium.

(2) A recent attack of dysentery or diarrhea, or the existence of either of these in chronic form.

(3) Recent acute malarial attack. Often the giving of magnesium sulphate will precipitate a severe malarial chill where a chronic malarial infection exists, and if this occurs in giving the treatment for hookworm disease the treatment is held responsible for the illness which results.

(4) Extreme shortness of breath on slight exertion, pulsation of the veins in the neck, or extreme palpitation and irregularity in the heart's action, with cough. These symptoms may indicate a dangerous organic heart lesion which would make the treatment for hookworm disease unsafe.

(5) A chronic cough, with loss of flesh, and evening fevers and sweat. It is not safe to give treatment to well-developed cases of pulmonary tuberculosis except in hospitals.

(6) In female patients between the ages of 15 and 45 the possibility of an unsuspected pregnancy should be investigated before treatment is administered.

Directions to Nurses for Administering Treatments

(1) A dose of magnesium sulphate (see Dosage Table) is given on the night before the thymol is to be administered. With the more intelligent classes of people the dose of salts may be left to be taken at bed time. The patient should be advised to refrain from eating supper, or in any event to eat only a light meal, avoiding greasy foods.

(2) No breakfast is to be eaten by the patient the following morning. At the time agreed upon the nurse is to call on the patient and ascertain if the dose of salts given the night before has thoroughly cleared out the alimentary canal and if the patient has refrained from food as directed. If these conditions are found favorable, the nurse administers the first dose of thymol, and in two hours the second dose.

(3) Two hours after the second dose of thymol is given the nurse administers a dose of magnesium sulphate.

Both doses of thymol and the dose of magnesium sulphate which follows them should always be given by the nurse, who must assure himself, before leaving the vicinity of his patient, that the last dose of salts has acted thoroughly and has cleared away the dead worms and the thymol from the alimentary canal.

(4) While the nurse is administering treatment at other nearby homes, the patient should be instructed to summon the nurse if any untoward symptoms develop, and to notify him if the dose of salts does not act within two hours after it is given, in which case the dose is to be repeated.

VI

CONTRACT WITH SUBORDINATE EMPLOYES

I, the undersigned, accept employment with the ....Ankylostomiasis Commission at a monthly salary agreed upon between the medical director and myself in the presence of witnesses, under the following terms and conditions:

First, the services which I am to perform will be under the medical director of the....................Ankylostomiasis Commission and consist of any duties he may assign to me.

Second, I am employed on the condition that I shall be able to perform to the satisfaction of the medical director the duties assigned to me, exercising at all times due diligence and faithfulness to duty in all services required of me.

Third, in case I am not able to accomplish such duties as are assigned to me to the satisfaction of the medical director, or am insubordinate, or for other just cause am dismissed, I agree to accept two weeks as sufficient notice of my dismissal from the service of the.......... Ankylostomiasis Commission, and to waive all claims to a longer term of notice of dismissal or to salary for any time beyond the two weeks for which this notice is given.

Fourth, I agree that misconduct and absence from work, unexcused by the medical director, will entail a deduction from my monthly salary.

Fifth, I further agree that in case I resign from the employ of the......................Ankylostomiasis

Commission I shall give the medical director two weeks' notice of my resignation from the service.

Signed........................

Title of Employe...............

Note: In case of nurses a sixth clause is added:

Sixth, I further agree to provide myself with a bicycle or such other means of travel as may be required of me by the medical director of the..................Ankylostomiasis Commission, and to maintain the same at my own expense throughout my term of service as nurse in the force of the...................Ankylostomiasis Commission.

VII

SAMPLE CIRCULAR USED IN BRITISH GUIANA

HOOKWORM DISEASE

YOU MAY BE TREATED AND CURED FREE OF COST

The International Health Board, working with the Colonial Government, will give FREE examination and FREE treatment for HOOKWORM DISEASE to every man, woman, and child.

In each district will be established a FREE DISPENSARY with a force of skilled men to examine the people, and a PHYSICIAN in charge who has had wide experience in the treatment of this disease. Many thousands have already been examined and treated on the EAST and WEST BANKS and on the EAST COAST from KITTY to BUXTON inclusive. As a result the people in these areas are much stronger and healthier than before. Now this great boon is offered to you for the first time FREE OF COST. Investigations already made show that about six out of every ten of the people in the villages have this disease, and many of these people are SICK AND WEAK on account of it.

Many of the ailments of which people complain are due to the presence of the HOOKWORM in the body, where they may exist in HUNDREDS and where they BITE THE INTESTINES and SUCK THE BLOOD, thus sapping the strength and vitality of their victims. The symptoms of the disease are many. Some, but NOT all of them, are as follows: — HEADACHE, DIZZINESS, INDIGESTION AND DYSPEPSIA, PALPITATION OF THE HEART, KIDNEY TROUBLE, DROPSY, PALENESS, SHORTNESS OF BREATH — which may be so severe as to be called ASTHMA — CONSTIPATION, WEAKNESS, and STOPPING OF PHYSICAL AND MENTAL GROWTH and DEVELOPMENT. Often the symptoms are so mild for a long time that the victim does NOT SUSPECT THE PRESENCE OF THE DISEASE UNTIL GREAT HARM HAS BEEN DONE. Therefore, no one can consider himself safe until an EXAMINATION WITH THE MICROSCOPE shows him to be free. We often find people who think they are in good health until our examination shows that they are infected.

The HOOKWORM lives in the small intestine and FEEDS ON THE BLOOD. The female lays hundreds of eggs every day. These never hatch in the body, but must be passed out in the bowel movements and deposited on the ground or they do not hatch. Those which are deposited on the ground hatch into worms too small to be seen. These worms live in the soil wherever the ground is contaminated. From the soil they usually get upon the feet and pass through the skin in a few minutes, and then into the blood, and after a few days they have found their way into the small intestine, where they live for

years if not treated. When they pass through the skin they cause sores which itch and fester, and which are commonly called GROUND ITCH when occurring on the feet. So it may be said that ANYONE WHO HAS HAD GROUND ITCH HAS HOOKWORM DISEASE. However, ONE WHO HAS NOT HAD GROUND ITCH MAY HAVE HOOKWORM DISEASE. This is true because in some cases the worm GETS IN THROUGH THE MOUTH ON VEGETABLES AND FRUITS WHICH ARE NOT COOKED BEFORE BEING EATEN. THE WORMS AT THIS STAGE ARE SO SMALL THAT THE MOST CAREFUL WASHING MAY NOT REMOVE THEM. On this account no one will be safe from the disease under present sanitary conditions. SOME OF THE RICHEST AND MOST INFLUENTIAL PEOPLE IN DISTRICTS WHERE WE HAVE WORKED BEFORE, HAVE HAD THE DISEASE. The EXAMINATION, which is necessary, consists in having each individual, from the youngest to the oldest, furnish us with a small bit of bowel movement, and with this his NAME, AGE, ADDRESS, and RACE, for purposes of identification and record. This specimen of bowel movement is examined by an expert at the Dispensary, and if HOOKWORM EGGS are found we know that the person is infected, and treatment is given. Our men will call at your homes and give you small boxes to collect the specimens in, and will also deliver the medicine to you there so you can take it without inconvenience. The treatment is not severe and the cure is certain and speedy to all those who faithfully take treatment regularly, and to all who are cured is issued a certificate of health. The above examination also enables us to determine if the person examined has any other worm or parasite. The OBJECT of our work is to ERADICATE this disease entirely, and show the people how to protect themselves from it in the future. To do this it will be necessary to EXAMINE EVERY PERSON in the territory where we are working. It is plain to any one that we would fail to stop the progress of this disease if any cases were left untreated, for it is an infectious disease, and every case originates from some other case.

In view of this fact it would seem to be the duty of every official — every intelligent, progressive citizen — not only to have himself and his entire household examined, but also to use his influence with his friends and acquaintances to secure their co-operation in this work. Already more than A MILLION people have been treated in the United States by taking advantage of the same offer which is being made to you. If you are free from the disease you should want to know it. If you have the disease you should be treated and cured, for it is a serious malady often resulting in DEATH, either directly or indirectly, and no person who has it can ever hope to be as useful, happy, or prosperous as he would otherwise be. Talk this matter over with your friends and neighbours, and help us to help you. You are cordially invited to attend the lectures which will be given on this and other diseases from time to time, of which you will have further notice; and also to call at our DISPENSARY and see the work actually in progress.

VIII

DESCRIPTION OF SPECIAL CENTRIFUGE

No. 19002 Double-Speed Hand Centrifuge with separate clamp, equipped with Stewart panhead with nut for fastening to centrifuge shaft.

Accessories:

(1) Special glass tubes, heavy wall, open at both ends to fit clips of Stewart panhead.
(2) Glass funnels, 40 m.m., or special paper funnels.
(3) Vials, flat bottom, 25 m.m. high, 15 m.m. in diameter.
(4) Corks for Centrifuge Tubes, No. O, XXXX quality

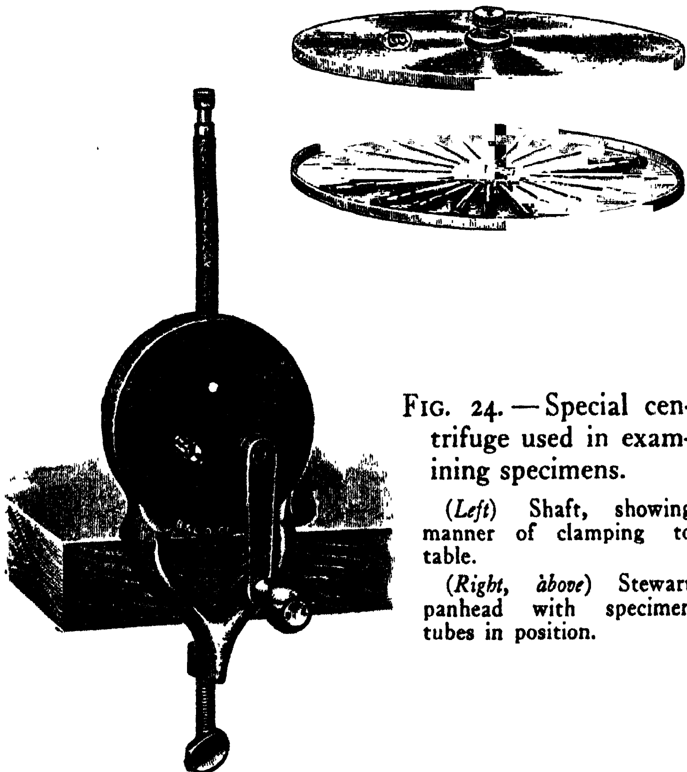


FIG. 24. — Special centrifuge used in examining specimens.

(*Left*) Shaft, showing manner of clamping to table.

(*Right, above*) Stewart panhead with specimen tubes in position.

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